





W. Mitchell Jr 1869

SECOND PART

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OR,

TRANSACTIONS OF THE SOCIETY

INSTITUTED IN BENGAL,

FOR INQUIRING INTO

THE HISTORY, THE ANTIQUITIES, THE ARTS AND
SCIENCES, AND LITERATURE

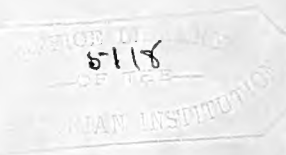
OF

A S I A.

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The Author takes this opportunity of expressing his obligations to the Printers.

Mr. Tassin, at whose Press the plates were struck off, had no interest in the work of a pecuniary nature, since the drawings were lithographed by the author's artists, under the pay of the Society during the time they were so engaged. Mr. Tassin's only charges therefore were merely for printing and paper—a profitless way of employing his Presses.

Of the manner in which the text is printed, any one who has paid attention to the progress of printing in Calcutta may judge. The author, however, owes it to Mr. Ridsdale to say, that he found him as solicitous for every thing on which the appearance of this part of the work depended as himself, and that any errors which have occurred in its execution are the author's.



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Errata.

- Page 239, Line 8 from bottom, for *polioxus*, read *leucerus*.
Page 270, Line 11 from top, for *hetea* read *petea*.
Page 272, Line 7 from bottom,
Page 312, Line 12 from top,
Page 342, Line 11 from top,
Page 347, Last line.
Page 279, Line 5 from bottom, for *here* read *where*.
Page 281, Line 7 from top, for *rupiculus* read *rupicolus*.
Page 285, Line 13 from top, and second from bottom, for *pyropterus* read *pyrropterus*.
Page 292, Line 6 from bottom, for *rasobora*, read *rasbora*.
Page 298, Line 5 from bottom, for *widedy* read *widely*.
Page 287, Line 12 from bottom, and
Page 290, Line 3 from top, and
Page 300, Line 8 from bottom,
Page 309, Line 1 and
Page 441, Line 13 from top,
Page 314, Line 9 from top, for *pyropterus*, read *pyrropterus*.
Page 314, Line 6 from top, and
Page 373, Line 13 from top,
Page 315, Line 2 from bottom, for *Hormay* read *Hannay*.
Page 336, Line 4 from top, and
Page 337, Line 11 from top,
Page 342, Line 2 from top, for *B. progastus*, read *Oreinus progastus*.
Ditto, Line 17 from top, for *preceeded*, read *preceded*.
Page 344, Line 10 from bottom, for *Pl. 30.* read *Pl. 39.*
Page 398, Line 7 from bottom, for *macrouru* read *macrourus*.
Page 422, Line 8 from bottom, for *acanthopterus* read *latipinnatus*.
Page 452, Line 8 from top, for *lamyhur* read *lamghur*.
Plate XLV, Four Perilamps is by mistake marked LVI.
Plate LIX last figures right lower corner, for 13 read figure 14.

Addenda.

- Page 220, Line 6 from bottom, omit, *Mirgul*, and insert the following species figured by Buchanan: *Cyprinus chola*, *Conchoniis*, *Jogia*, *Shakra*, *Barna*, *Vagra*, *Borila*, *Anjana*.
Page 291, Line 11 from bottom, after the words "dorsal and anal small," insert, "the former opposite to the ventrals."
Page 299, Line 4 from top, after the words "intestine is short, and" insert, "the body"
Page 345, After *O. MACULATUS*, J. M. insert *Pl. 57. f. 6.*

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I.

INDIAN CYPRINIDÆ.

BY MR. JOHN McCLELLAND,

ASSISTANT SURGEON BENGAL MEDICAL SERVICE.

Presented, 5th September, 1838.

DR. PATRICK RUSSELL published in 1803 an account of 200 species of fishes found chiefly on the coast of Coromandel; there appears to be no copy of his work in Calcutta, nor have I been able to meet with it in India; but his collection appears to have embraced few *Cyprinidæ*, and scarcely any of those afterwards found in Bengal by Dr. Buchanan.* The fishes of Ceylon as well as those of the Bay of Bengal have recently excited the attention of naturalists,† while those of the Sunderbuns and the vicinity of Calcutta have long been objects of interest to collectors for the Museums of France and the other parts of the continent, where alone ichthyology seems to have been cultivated as a philosophical branch of zoology.

* Afterwards Dr. BUCHANAN HAMILTON. As most of his publications have appeared under the name of Buchanan, authors should follow the example of Cuvier in the *Règne Animal* and *Histoire Naturelle Des Poissons* in referring to the author of the Gangetic Fishes by the name by which he is best and will be universally known, in proportion as his vast works on Indian statistics and Natural History transpire.

† Mr. Bennett and my friend Dr. Cantor.

2. Dr. Buchanan appears to be the only author who has devoted his attention to the fresh-water fishes of Bengal, and his success seems to have left little for others to do in the way of discovering new species. His *Gangetic Fishes*, published in Edinburgh 1822, contains descriptions of no fewer than eighty Cyprins, of which number he has only given figures of twenty-one. And unfortunately, Cuvier appears to have adopted such only as were figured in that work, leaving the rest as doubtful materials, which from their extent, and the deficiency of the details connected with them, perhaps deterred him from the task of entering into, or finishing, his account of the Carps in the hope of receiving further particulars regarding them from India.

3. It was partly with a view of supplying this deficiency that I devoted the time we spent on rivers during our* journey to Assam in the winter of 1835-6, to the examination and figuring of species. The obscurity of Buchanan's specific descriptions, which with few exceptions are chiefly composed of characters of generic value, rendered the task of identifying his unfigured Cyprins most difficult and uncertain. Nevertheless it appeared to me to be a desideratum that must be accomplished sooner or later by some one, and at length, after perseverance for the better part of three years, occasionally giving it up in despair, I succeeded in identifying most of the species unfigured by Buchanan, as well as in having made two series of finished drawings of them, one set for England and one for India. After all this, and after the present paper had been ready for publication in April last, my notice was for the first time attracted by a remark of Buchanan, in consequence of which I thought it necessary to make inquiry for certain drawings alluded to *Pisc. Gang.* p. 316. I had heard of drawings at the Botanic Garden, but never saw them; and always supposed them to be merely the originals of published figures; but I confess I was quite unprepared to receive at that time a collection of drawings from Dr. Wallich

* I allude to the deputation of Dr. Wallich, Mr. Griffith, and myself to Upper Assam.

amounting to 150 beautifully executed, and including nearly all the unpublished species on which my painters had been so long employed, with the specific names in Buchanan's hand-writing marked under the figures, so as to leave no doubt or difficulty in referring them to corresponding descriptions in the *Gangetic Fishes*. I am not prepared to state how many unfigured species this interesting collection contains, except in the particular family which is the subject of this paper. Along with these drawings I received information from Dr. Wallich that two folio volumes of manuscripts and drawings on general zoological subjects by the late Dr. Buchanan still remain at the Gardens. The descriptions alluded to may probably serve as a key to Hardwicke's *Illustrations*, into which I perceive several figures of *Cyprinidæ* have been accurately copied except in the colouring, from Buchanan's drawings; and as no descriptions of the plates of Hardwicke's work have been yet to my knowledge published, the source from whence the figures in question came does not transpire, and there is no allusion to it on the plates; at any rate it is unfair to General Hardwicke as it is to Dr. Buchanan, and to all who are engaged in pursuits connected with the Natural History of this or any other country, to have the unpublished works of any man shut up for twenty-two years in a library that is not open to the public.*

* Buchanan's Researches regarding the fishes of India commenced on his arrival in the country in 1794, and ended with the publication of the *Gangetic Fishes* in 1822. Anything that tended to lessen the value of a work that occupied so much of such a life is to be regretted. It is stated in a biographical notice of Buchanan in Chamber's *Lives of Scotchmen*, that on his departure from India he was deprived by the Marquis of Hastings of all his extensive drawings and papers relating to every branch of Natural History, *particularly Botany*, "although to me," quoting his own words to the Edinburgh Philosophical Society, "as an individual they were of no value, as I preserve no collections, and have no occasion to convert them into money, but I was merely desirous of seeing them safely deposited in the India House." In deciding that Buchanan's papers should be retained in India, it may be presumed that the object was that they should here be rendered more useful to the country than they could be in England. It could scarcely have occurred to the Marquis of Hastings that these works would be consigned to oblivion and the author in consequence superseded by his successors.

The following are the names of the unpublished figures of *Cypri-
nidæ* in this collection of drawings.*

Cyprinus Gugani, Buch.	Cyprinus Bangana, id.
———— Gorachela, id.	———— Pangusia, id.
———— Joya, id.	———— Sarana, id.
———— Cachius, id.	———— Kunta, id.
———— Loubuca, id.	———— Tor, id.
———— Phula, id.	———— Sada, id.
———— Bhola, id.	———— Lati, id.
———— Gora, id.	———— Gohama, id.
———— Borelio, id.	———— Godeyava, id.
———— Rerio, id.	———— Dheno, id.
———— Dangila, id.	———— Jauyali, id.
———— Balibola, id.	———— Paungsi, id.
———— Bukrangi, id.	———— Bimaculatus, id.
———— Loya, id.	———— Sucatio, id.
———— Phulchela, id.	———— Balitora, id.
———— Titius, id.	Cobitis Gongota, id.
———— Terio, id.	———— Balgara, id.
———— Sutiha, id.	———— Cucura, id.
———— Phutunio, id.	———— Guntea, id.
———— Gelius, id.	———— Botea, id.
———— Kanipunte, id.	———— Pangia, id.
———— Casuatus, id.	———— Biltura, id.
———— Cursis, id.	———— Turia, id.
———— Cursa, id.	———— Scuturiginum, id.
———— Mirgul, id.	———— Savona, id.
———— Bata, id.	———— Corica, id.

* But although they seem to have been withheld from Buchanan himself, the following drawings from his original collection of unpublished figures of fishes have found their way from the Botanic Garden into Hardwicke's Illustrations, without any acknowledgment to point out from whence they were derived.

4. An examination of the viscera connected with the digestive organs together with the form of the mouth, suggested the possibility of identifying

Tab. 84. *Hypostomus sisor*, Buch. *Sisor Rabdophorus*, id. *Gan Fis.* two drawings.

T. 85. *Malopterus Kazali*, Buch. Two figures; name changed to "*Malopterus (Ailia) Bengalensis*" Gray, in the pirated figures.

T. 86. Fig. 1. *Cyprinus angra*, Buch. Pirated figure disguised under bad colouring, and named "*Cyprinus Hamiltonii*" Gray. Fig. 2. *Cyprinus goha*, Buch. Colouring much exaggerated. There are two figures of each species, so that this plate has been taken wholesale from Buchanan.

T. 87. Fig. 3. *Cyprinus chedra*, Buch. A good copy of a very beautiful drawing in Buchanan's collection.

T. 89. Fig. 1. *Syngnathus carce*, Buch. (Kharke id. orig. draw.) Note—an error in spelling the generic name of this species as written by Buchanan on the original drawing, is preserved in the pirated copy. Fig. 4. *Syngnathus deokpata*, Buch.

T. 91. Fig. 1. *Mystus chitol*, Buch. Colouring much exaggerated in the pirated copy.

T. 93. Fig. 1. *Cyprinus mosal*, Buch. Two figures, and two of *Cyprinus morala*, id. The coloured copy of this last is so badly executed that the characteristic marks of the species, though well depicted in the original by the obscure transverse streaks crossing the sides, are quite omitted in the copy.

T. 94. Fig. 1. *Cyprinus tileo*, Buch.

T. 95. Fig. 1. *Ophisurus boro*, Buch. The species is referred to Buchanan's manuscripts, but nothing is said to point out from whence the drawing was obtained, but it is so accurately traced from Buchanan's original, as to remove any doubt on that score. Fig. 2. *Ophisurus harancha*, Buch. By mistake on the part of the plagiarists in numbering the figures, the details of the first, are given to the second species. Fig. 4. *Murcena railaborua*, Buch. disguised under the names of *Rataboura "Hardwickii"* Gray; thus not only depriving Buchanan of the honor of figuring, but also of naming a new species. As an instance of the little reliance to be placed on those who thus appropriate the works of others, it is necessary to observe that the outline figure representing the lower parts of *Murcena railaborua* is transferred to *Ophisurus bora*, in return for that of the last having been given on the same plate to *Ophisurus harancha*. In other plates not numbered, forming 19th and 20th parts, are pirated as follows;

something on which the natural arrangement of fishes might be founded. In those Carps whose mouths are constructed for the collection of vegetable

Holocentrus? *Kalkaya*, B. MS. two figures name changed to 'Pterapon Trivittatus'. *Cottus chaka*, B. MS. name changed to 'Platycephalus chacca', marked 'Natural size'. *Checlodipterus Bhutibue*, B. MS. name changed to 'Checlodipterus Butis', and the species referred to 'Hamilton', but nothing said of the source of the two figures. *Cyprinus morar* B. MS. two figures and *Cyprinus gora*, B. MS. forming an entire folio plate, the name of the latter changed to 'Cyprinus cora.' *Clupanadon chapra*, B. MS. pirated figure called 'Alosa chapra N. Indian Ocean', what the latter terms mean I cannot say, as the figure is from Buchanan's unpublished drawings of Gangetic species; like the remark 'natural size', annexed to *Cottus chaka*, it is certainly calculated to impress the reader with the belief that the author had seen the specimens from which the drawings were made. Neither of the remarks in question appear on the original drawings, which are characterised in Buchanan's hand writing.

Buchanan died in 1829. The work to which so much of his labour has been transferred was published in 1833, and although no descriptions of the plates have yet appeared, it is no excuse for having suppressed the source from whence so many of them at least were derived, especially, when it was thought necessary to acknowledge the source of other figures in the same work. These circumstances induced me to visit the Botanic Garden, with a view of ascertaining if all the other plates in Hardwicke's Illustrations, as well as those of fishes, were derived from the two folio volumes stated to be in the Library of that Institution. The following memorandum which was made on the occasion, must be interesting to all who are in any way connected with zoological pursuits.

" Botanic Garden, 3d September, 1833. Having obtained the requisite permission, I inspected Buchanan's Zoological MSS., for the first time;—they seem to contain descriptions and figures of the following animals:—

" Five species of *Simia*, one recently described by Dr. Harlan, in the American Phil: Transac: as *Simia Hoolook*.

" Five species of *Felinæ*, one gray above and spotted beneath, and a *Felis leopardus albus*, an *Ursus*.

" Six *Cervidæ*; a *Cervus niger*, Buch. Several species of *Mus*, two bearing Buchanan's specific names, also an *Ichneumon* and a *Hysterix opeigura*, Buch. three species of *Capra* bearing his specific names, as well several species of Tortoises, two species of flying Foxes, two *Lacertæ*, and two *Paradoxuri*.

food, I found, as might be expected, the greatest development of intestinal canal; in these the mouth is invariably either horizontal or directed downwards, as in the Cirrhins; all such types I have included under the head of *Pænominae* or herbivorous Carps, of which the Gudgeons and Gonorrhynchs are the most remarkable.

5. In the last mentioned genera the mouth is situated completely under the head, and is constructed in the Gudgeons for bruising soft vegetable

“Of birds, I observed about sixty species of *Falconidæ*, about 150 *Insessores*, and about 74 *Grallæ*, including many rare *Tantalidæ*, and the species of *Ciconia* recently described as *C. cristata*, which appears to have been named nearly 30 years ago by Buchanan *Ardea crinita*; all which, in addition to the fishes, are drawn in duplicate, thus amounting to about 900 drawings.” Although Buchanan was professedly a botanist, his researches appear to have extended to all branches of natural history except entomology. His volumes on Gangetic Fishes, published at his own expense, under the disadvantage of being deprived of the greater part of his figures, are the only part of his zoological labours that are known; yet his inquiries in other branches of zoology were equally extensive, and equally intitled to publicity. It now appears that two quarto volumes of MSS. written with his usual erudition, have been retained in the Library of the Botanic Garden since 1815, while every periodical that has since appeared deprived him of some portion of those claims to priority which his papers ought to have secured to him had they been placed in proper hands, or deposited in an institution where their existence could have been known or appreciated.

Had such an injury to the advancement of information resulted from an oversight in an ordinary public office, the circumstance would excite less surprise; but that the works of a naturalist should be so treated in a public Institution expressly intended for the promotion of science, is so unaccountable to me, that I cannot presume to express an opinion on the subject. But as the case stands, perhaps the best remedy that can now be applied in justice to Buchanan, as well as to others who are still engaged in scientific pursuits, would be to give a complete edition of his labours, botanical and zoological, to the public, at the same time it is right to say that no atonement can now make amends for the injury that has been inflicted on Buchanan as a naturalist, or for the time that has been lost in allowing others to go over unnecessarily the ground which he investigated, instead of beginning where he left off.

substances, such as are found in stagnant waters, and in the Gonorhynchs for tearing and uprooting certain kinds of confervoid plants, which form a short slimy covering to the rocks on which they grow in clear mountain streams.

6. The true Cyprins (*Cyp. proprius* Cuv.) together with the Barbels, Cirrhins, and Labes, subsist less exclusively on a vegetable regimen. Their mouths are invariably small, and either directed downward or situated low in the head; and as far as my inquiries have extended, it is on such modifications of the mouth that we find the length of the intestines and the habits of the different groups to depend.

7. In the Gudgeons the mouth is formed simply for receiving a kind of food that is obtained in abundance without any effort, and which requires no prehensile teeth or other organs for its collection or preparation before it is submitted at once to the process of digestion. The mouth is consequently small, and is opened and closed chiefly by the muscular structure of the snout; the jaws are weak, and the lips hard and cartilaginous, without sensibility or muscularity, and their intestinal canal varies from eight to eleven and even twelve lengths of the body, including the head and caudal fin; except in the *Hypostomi*, Lacep. among fishes, Ostrich among birds, and perhaps some of the ruminants, such development of the abdominal canal is rare, a circumstance which it will be necessary afterwards to recollect when speaking of types.

8. In the Gonorhynchs the muscular power of the snout is greater than in the Gudgeons; the mouth is smaller and situated farther back in the lower surface of the head, the lips thicker, and though defended externally by a hard insensible cartilage, are formed for very powerful muscular action. In this genus the length of intestinal canal is usually about eight lengths of the body, and exceeds that of all other Cyprins except the Gudgeons.

9. The development of the intestinal canal in *Cyprinidæ* differs with the habits of species, so as to afford something like a basis for true distinctions between the different genera, and is fortunately connected with such peculiarities of form and colour, as to render it easily available as a guide to an improved method of classification.

10. The philosophical views of Mr. MacLeay regarding the circularity of groups, left it almost certain that the law which applied to other classes might be also applied to fishes; and as the essence of that law consists in the tendency of the contents of natural groups to form a circle, it became highly probable that as strictly herbivorous Carps were known, so on the contrary carnivorous species might be expected also to exist.* This is exemplified by a comparison of typical with subtypical groups, as *Quadrupedia* with *Feræ* in the orders of *Mammalia*, and *Insectores* with *Raptores* in the orders of birds; as this is true with regard to higher groups, it should be just as applicable to the lower assemblages when they happen to be equally complete in their parts.

11. The above inference whether its principles be just or not, has proved to be perfectly correct, notwithstanding the remark of Linnæus that Cyprins are perhaps the least carnivorous of the whole class of fishes, "feeding chiefly on seeds, grass, and even mud;" and the observation of Cuvier "that they are the least carnivorous of all fishes." Those who have since written on the subject have for the most part adopted the views on this point of the great authorities just named.

12. A close investigation of our Indian species has led to very different results, and enabled me to form *Cyprinidæ* into three sub-families. First the *Pæonominæ* or herbivorous Cyprins already adverted to, which

* I here refer particularly to what Mr. MacLeay calls affinity of transultation, or that relation which the opposite points of a circle of affinities bear to each other.

consist of species whose habits accord with the views of Cuvier and Linnæus; and *Sarcoborinæ* or carnivorous Cyprins, consisting of several natural genera; and *Apalopterinæ*, including the *Cobitinæ* or Loaches, the *Pæcilianæ*, *Cyprinodons*, and other genera which in the Regnè Animal appear to have little connexion with the family, as well as some new forms peculiar to India.

13. As the peculiarities of the first sub-family, consisting in the form of their mouth and digestive organs have been pointed out, I shall now proceed to notice the characteristics in structure and habits of the several groups of *Sarcoborinæ*. Two of the most remarkable genera of this sub-family are the *Perilamps* and *Opsarions*; the first, consisting of small insectivorous fishes remarkable for the brilliancy of their colours, always disposed in streaks. The second are lengthy handsome species, larger than the *Perilamps*, though still of small size and very bright in their colours, which are however disposed in cross bars,—these are exclusively carnivorous, and remarkably voracious.

14. The *Perilamps* (*Perilampus*) form the connection between the Systems and Leuciscs. The mouth is placed in a directly opposite position from that which it occupies in the typical forms of the *Pæonominæ*; the jaws are directed upward, and their apices are placed on a level with the back or crown; their intestine is short, and in no instance exceeds the length of the body, and their food consists of insects only, which they derive by springing from beneath the surface of the water, thus forming a direct contrast to the *Gonorhynchis* and other *Pæonominæ* whose food is exclusively derived from sandy, rocky, or muddy bottoms. Eleven or twelve species of this new genus are described in this paper.

15. The *Opsarions* (*Opsarius*) differ from herbivorous Cyprins still more widely in their economy and habits. The body is long, the mouth widely cleft and horizontal, and though without teeth, the symphysis of the lower jaw is armed with a sharp hook in the more characteristic, but which is blunter and less prominent the further we pass from the most typica

forms ; but this hook more or less developed, is characteristic not merely of the Opsarions, but of the sub-family (*Sarcoborinæ*) to which they belong. It is received into a corresponding depression in the apex of the upper jaw when the mouth is closed. The back is straight, the dorsal is placed opposite to a long anal, both fins being situated near the caudal extremity, by which the power of darting or springing is rendered most perfect.* The abdominal cavity is long, and is chiefly occupied by a straight stomach of equal length, which is divided by a strangulation from a short fleshy intestine connecting the stomach directly with the vent, without any convolutions or elongation of the tube.

16. "The energies of nature," to use the words of Mr. Swainson, "are here concentrated as it were to the production of that form most adapted for one especial purpose," that of springing on their prey like the *Felinæ* or cats, which they seem to represent. It is no uncommon thing to find an Opsarion so overgorged that the tail of its prey remains protruding from the mouth, to be swallowed after that portion which is capable of being received into the capacious stomach is sufficiently digested to admit of the introduction of the remainder.†

17. Two other genera of this sub-family remain to be noticed ; viz. *Systomus* and *Leuciscus*. The first is made up chiefly of small species named Pungti by the Indian fishermen. If we were merely guided by their general

* The principal instrument of progressive motion in fishes is the caudal fin ; other fins, as shewn by Roget, are mere auxiliaries, serving to balance the body while it receives propulsion from the tail. Vide Bridgewater Treat. i. 286. This is correct in regard to fishes in general, but in the Opsarions and Perilamps the dorsal and anal, from their position and size, contribute greatly to their velocity, being also situated on or near the tail, thus increasing the caudal surface, which, as Roget justly observes, operates as an oar does in sculling.

† I have seen Opsarions so often in this state, that I presume they are easier caught in it than in any other. A similar power of deglutition is recorded of sea-gulls by Blumenbach.

appearance and the form of their fins, the only principle of division hitherto adopted in this family, they might be brought into the several sub-genera *Cyprinus proprius*, *Cirrhinus*, etc. of the *Regnè Animal*. Buchanan, who published his *Gangetic Fishes* contemporaneously with Cuvier's system had not an opportunity of consulting its divisions, while those of Lacepede, Bloch, and previous writers were not reconcilable to Indian species; Buchanan therefore formed temporary groups for his own convenience, applicable to the local features of the family in this country. The Pungti, like all his other groups, were formed according to native opinions of their habits unshackled by artificial views, and being better marked than most genera, Buchanan's Pungti have more or less affinity to each other.

18. The stomach and intestine of the *Systemos* are in none of the species I have examined more than thrice the length of the body, and the former which is thick and fleshy, usually contains the remains of insects. The mouth is small, and when opened, the intermaxillaries project so as to form a narrow tube,—hence their generic name.

It is in the *Systemos* we first perceive a tendency to the hook or prominence on the apex of the lower jaw after quitting the herbivorous genera, and for this reason, as well other peculiarities which appear to point them out as a typical or most perfect group, they are placed first in the list of carnivorous genera.

19. The *Leuciscs* or white fishes, succeed the *Perilamps*. In this genus the prominence on the lower jaw is more distinct, and I have restricted the genus to such as possess this character, having at the same time the dorsal and anal small, the former placed anterior to the latter. They are all carnivorous, but not constructed for leaping above the surface like the *Perilamps*, nor for springing like the *Opsarions*; although the shortness of the intestines, size of the stomach, and prominence of the tooth on the

lower jaw prove them to be scarcely less rapacious; yet I am not sure as to the accuracy of separating them from one or other of the preceding genera, merely on account of the size and position of the dorsal and anal fins, particularly as the dental hook is only of importance in distinguishing them from some of the *Pæonominæ*.

20. After this outline of the structure of *Sarcoborinæ*, a few remarks regarding their colours will be necessary, as embracing another principle on which the divisions have been formed. The whole of the sub-family *Pæonominæ* are remarkable for their uniformly plain colours, consisting of olive-green, bluish-grey, or brown extended along the back, and softened off on the sides so as to leave the lower surface of the body an impure white, partaking more or less of the colours of the back. The fins partake of the sober hues of the adjoining parts of the body, the pectorals and ventrals, as well as the branchial membranes and irides usually displaying after death a slight blush of red caused by the capillary effusion of blood in those parts. Of the species with which I am acquainted, not one possesses a brilliant spot of any pure colour, but when we approach the limits of the next group we begin to find in the *Gonorhynchis*, obscure dark spots on either side of the tail of some of the species, as *G. bimaculatus*.

21. But, on the other hand, as soon as we cross the verge of the herbivorous group and enter the carnivorous, we find such spots as those alluded to become brighter and more numerous, and the opercula and fins to be stained with yellow and red in deep and natural tints. To *Systomus*, the first genus of this group, the Gold-fishes,* commonly called Golden Carp belong. The intestinal tube of the *Systomus* though only thrice the length of the body, or half the length of the abdominal tube in those herbivorous species in which it is shortest, is nevertheless twice the length of the same organ in any of the

* *Cyprinus auratus auctorum*.

other *Sarcoborinæ*. As we advance in this sub-family from the Systems towards the Opsarions, we find as has been shewn, the abdominal tube diminishing in length, and in proportion as this takes place, and the habits of species become more carnivorous, we observe the brilliancy of the colours becomes more remarkable.

22. The Perilamps, as already stated, are followed by the Leuciscs. In these the diversity of colour is not great, but is compensated for by the metallic brilliancy of the nacre, or silvery pigment with which the scales and opercula are covered, and from which the genus has derived its name *Leuciscus*, *Ables*, or white fishes, though not applicable to all the species; for there is one which is marked on each side with the bright longitudinal streak of the Perilamps, and like the blending of the markings already observed between the *Pæonominæ* and *Sarcoborinæ* the species in question, *Leuciscus lateralis*,* seems to unite the white fishes with the Perilamps.

23. The Perilamps in their structure naturally follow the Systems, and present numerous bright longitudinal lines of various colours, but particularly blue on their sides. They are all small species of little or no direct utility to man, nor is it possible to account for the peculiar brilliancy of their colours in any other way than as an instance of that inscrutable design, by which it would seem that in pursuit of aquatic insects on which they subsist along the surface of waters, they become the better marks for Kingfishers, Skimmers, Tern, and other birds which are destined to keep the number of fishes in check, especially in deep waters beyond the reach of the waders.†

* *Cyp. Daniconius*. Buch. which appears to me to be identical with *Cyp. Anjano*, id.; but if not, the latter species on account of certain peculiarities about the mouth, which seem to be wanting in the former, must be referred to the Perilamps.

† See remarks on *P. perseus* in a subsequent part of this paper.

24. The Opsarions are *Cyprinidæ* that live upon other species of their own class ; they are no less remarkable for the peculiarity of their colours than for their remarkable structure and habits. Instead of the longitudinal stripes of the Perilamps, they are characterised by transverse bands or spots, having a tendency to form cross bars on the sides. The analogy between the structure and character of the Opsarions and *Felinæ* has already been referred to (16). Why the former should present similar external markings to those which belong to the most destructive types of quadrupeds and birds cannot well be accounted for on other principles than those of symbolical representation, by which an uniformity of design appears to extend throughout all the infinite forms in the animal kingdom. As an ignorant confidence in this or any other doctrine would be as absurd as a denial of any thing else with which we are imperfectly acquainted, the only way in which we can evince our respect for those who have opened so vast a field for inquiry is, to imitate their industry, leaving our views to be slowly formed and matured with the progress of inquiry—the only way in which sound or useful results ever were, or can be, elicited in scientific pursuits.*

Green appears to be the characteristic colour of the markings on the sides of Opsarions, as blue or purple forms those of the Perilamps ; and those Opsarions that are not either marked with transverse green bars, or oblong spots of the same colour transversely placed with regard to the body, are covered with a silvery pigment similar to that of the Leuciscs.

* Nothing is more easy, or more common because it is easy, than to announce as discoveries the startling results of immature inquiry into obscure subjects ; yet when we consider the comparatively small amount of real discovery solely attributable to Newton, compared with the extent of his application, and how seldom a Newton appears, we should always receive with suspicion the supposed discoveries of persons who from their frequent appearance in public, and the number of their occupations, argue a sad deficiency in all those qualities essential to the promotion of any science.

25. In consequence of the important connection between colour and structure here pointed out, I am in some doubt as to the nature of four small species described by Buchanan,* and figured in the collection of his drawings at the Botanic Garden. Two of them have been figured in the Gangetic Fishes, and one a second time in Hardwicke's Illustrations; but in the published figures, the peculiarity of the colours to which I allude, and which seems to have been preserved in the original drawings has been overlooked. They have the form of Cirrhins, but they are each marked with a dark spot at the end of the tail, and the colours of the back descend partially across the sides in bars as low as the situation of the lateral line. I have added the species in question to the Cirrhins as *Cirrhinoids*, until we know something more of them. Should they prove from the length of the abdominal canal to belong to *Sarcoborinæ* as their colours indicate, they will occupy a place between the Opsarions and the Loaches.

26. The third sub-family *Apalopterinae*, consists of the old Linnæan genus *Cobitis*, the *Anableps*, *Pæcilia*, *Lebias*, *Fundulus*, *Molinesia*, and *Cyprinodons*, as well as two other genera, *Platy cara*† and *Psilorhynchus*, to be described in a subsequent part of this paper. These fishes are all remarkable for their long cylindric bodies covered with a slimy mucous, the absence of spines in any of the fins, and the shortness of their alimentary canal.

Mr. Gray has recently separated the Loaches with suborbital spines from those that are without these singular organs. I have endeavoured to find farther reasons to strengthen this division, a single character being insufficient

* *Cyp. Dero.* Buch. Gang. Fis. Pl. xxii. f. 78. *Cyp. Morala*, id. Pl. xviii. f. 91. *Cyp. joalius* id. op. Cit. 316. *Cyp. Pausius*. id. loc cit.

† Named by Mr. Gray as Buchanan's *Baltora*, which rather correspond with my *Psilorhynchus*, *Psil. variegatus* being Buchanan's *Cyprinus Baltora*.

to distinguish a natural group without some more general reference to habits and structure. Not having been successful, I am obliged to resort to another arrangement which appears to be more natural, and at the same time equally obvious; the caudal of the one sub-genus (*Cobitis propria*) being entire, and that of the other (*Schistura*) bifid, or divided into two lobes as in the ordinary Cyprins. Colour is here a no less important guide than we have found it to be in *Sarcoborinæ*. Green disposed in bars and zones crossing the body characterises all the *Schisturæ* except a single species (*Botia grandis*, Gray) in which the colour is green, with oblong light yellow spots, or rather short interrupted streaks, irregularly disposed in all directions.

The true Loaches (*Cobitis prop.*) on the contrary are all brown, inclining in different species to red or yellow, disposed in nebulous blotches or obscure bars having a transverse tendency.

27. The structure of the digestive organs in the Loaches and *Schistura* does not appear to be very different, but in the latter the intestine seems to be somewhat longer than in the former, exceeding in the one genus the length of the body, while in the other it falls short of this. In both, the stomach is a small lunate sack placed cross-wise with regard to the body, with both orifices in the front, thus differing in this peculiarity from all other *Cyprinidæ* that I have examined. The mouth is small, and placed in the lower surface of the head, and surrounded by minute cirri. Besides the difference in the caudal fins, length of intestine, and colour in the two sub-genera of *Cobitinæ*, the body in *Schistura* is often arched above and below, and compressed the same as in *Cirrhinus* and the generality of Cyprins, but in *Cobitis propria* or true Loaches, it is almost cylindrical, and generally very long. Some of the *Schisturæ* are possessed of an air vessel placed as usual in the upper part of the abdomen, of an oval shape, and divided into two lateral cells by a

longitudinal septum; but in *Cobitis prop.* or Loaches with entire caudal, I have not found any trace of that organ in the ordinary position, but in different species that I have dissected, it is placed in a small bony case over the entrance to the œsophagus; this case consists of a single sub-globular cell, although in the European species it has been found to be bilobate. In those *Schisturæ*, on the other hand, which are without the abdominal natatory bladder, I find the organ situated over the entrance to the œsophagus as in *Cobitis prop.*, but formed of two small globular cells, joined together by an intermediate tube.

28. Having thus explained the general principles on which I have sub-divided the family, it may be useful to examine how far the results are likely to correspond with those laws that have been laid down as the basis of natural classification. With this view, we should first of all endeavour to ascertain the denomination of the family, or its relation in point of rank to fishes in general; but as this could only be done after analysis of the whole class, we can only attempt to form an estimate on the subject by comparing *Cyprinidæ* with what seem to be analogous groups in other classes, to which the philosophical views of Mr. Macleay, Mr. Swainson, Mr. Vigors, and other writers on the natural system have been extended.

29. It might be unnecessary in a communication of this kind, to offer any remarks on the general principles of the natural method of arrangement, as these are fully expounded in popular introductions that ought to be universally read, as well as in several papers that have been published within these last twenty years in the transactions of the Linnæan and other learned Societies. I may however remark, that in addition to those affinities by which animals are immediately connected, there are more remote relations called relations of analogy, by which they typify or represent each other, “a principle which,” as Swainson observes, “was in some degree perceived by

Linnaeus when he compared ruminating quadrupeds to gallinaceous birds,* both of which evince the greatest intelligence, docility, and contentment under the domestication of man." Appendages to the head, whether in the shape of horns, crests, or fleshy protuberances, and the property of affording wholesome and nutritious food, and otherwise contributing to the ease and support of man, are according to Swainson the chief attributes of the type to which the above analogy refers.

30. The Elephant, horned cattle, domestic poultry, etc. are common instances of the type alluded to, and if we compare their properties in their respective circles, with the *Cyprinidæ* in the order of abdominal malacopterygians, we may venture perhaps to look upon that family as the equivalent in its circle, to other rasorial groups in theirs.

31. The mouth of *Cyp. Calbasus*, Buch. is small, and directed downwards, the anterior lip is compressed by a pendulous muscular snout to which four short muscular cirri, different from the nervous filaments of *Siluridæ* are attached,† and the posterior lip is fixed to the ligamentous union of the transverse apophyses of the lower jaw. In the *Cirrhins* the lower jaw is composed of two short branches or bony limbs, obliquely inclined towards each other from their articulation to the blunt apex of the jaw, where they are united by ligaments instead of symphysis at the approxi-

* Such analogies were, as Mr. Macleay has shewn, known to Aristotle, by whom however, as well as all subsequent writers up to the time of Mr. Macleay himself, they were mistaken for affinities.

† The cirri of *Cyprinidæ* are soft and capable of being contracted and elongated, as well as the loose muscular appendages of the snout to which they are attached, particularly in the genus *Cirrhinus* Cuv. ; but in *Pimelodus aor*, Buch. and most of the *Siluridæ* I find the cirri are flat and cartilaginous, with a groove on either edge for the protection of a large nerve, an artery, and a vein. A *cirrus* so constructed is incapable of muscular action, and is strictly an organ of sense only, and not of prehension as in *Cyprinidæ*, and ought to be called a filament.

mation of a slender apophysis from each side. Figs. 4, 5, 20, 21, Plate 54, show the under side of the right ramus of the lower jaw (natural size) of four species, *a*, being the point of approximation with its fellow at the chin, and *b*, the articulating extremity behind.

32. This structure is evidently adapted to the habit of collecting fruits, seeds, and other soft substances from the muddy and sandy bottoms of indolent streams, in which loose detached objects of the kind are most likely to occur, and where they may be easily collected without bodily effort by means of these soft pendulous and prehensile organs attached to the lips. If to these characters we add the great size of the species compared with the rest of the family, and the plain dusky colour of the Cirrhins, their analogy to the proboscidian types of quadrupeds seems almost complete. But there are still other remarkable points of resemblance between the Cirrhins and rasorial forms among the quadrupeds, in the deficiency of teeth, and the weakness of the union of the two limbs of the lower jaw.

33. In the Elephant this jaw is only formed for grinding such substances as are introduced to the mouth by the proboscis; there are no cutting teeth, the use of which in gathering food being superseded by the trunk. In all animals possessed of such an organ, prehensile and cutting teeth appear to be less prominent according to the degree of its development; of this we have instances in the Tapirs and Edentates. In the *Sarcoborinæ* the incisors and prehensile teeth are represented by a formidable knob on the symphysis of the lower jaw, and in the *Pæonominæ*, where even this symbol is wanting, we find such of the genera as are without strong muscular appendages to the snout, furnished with a cartilaginous rim to the mouth, which in some, as the Gonorhynchs, is confined to the edge of the lower lip, as a covering or defence when employed in detaching their peculiar food from the rocks to which it is fixed, and may for this reason, be considered as the last semblance of a structure equi-

valent to cutting teeth ;* but in the Cirrhins even this is quite deficient. Nor does the analogy between these fishes and proboscidian quadrupeds end here ; the presence of cutting teeth implies a strong solid union of the two bony limbs of the lower jaw at the symphysis for their insertion, but in the *Edentates* and Elephants the symphysis is remarkably feeble ; the two sides of the jaw being nearly separated by a deep fissure almost detaching its limbs from each other, as actually occurs in the Cirrhins, with which I include Labeos, which are also furnished with similar prehensile organs in the form of thick pendulous lips. So many corresponding circumstances between animals so remote from each other in the scale of affinity, cannot be referred merely to coincidence, but rather to a law of symbolical representation, by which the same type appears throughout an infinity of forms in the several classes.

34. If *Cyprinidæ* be a rasorial group, as the above analogies of their most perfect forms with rasorial quadrupeds would seem to indicate, the same relations should appear on contrasting them with other classes, the corresponding points becoming more striking or faint in proportion as the groups with which they are compared are contiguous or remote from them ; therefore, as birds are nearer to fishes than quadrupeds, the comparison of analogous types between these classes should afford more striking results than those I have cited.

The most remarkable characteristic of rasorial birds is their shortness of wing, terrestrial habits, and consequent strength and size of their legs, which are formed for the principal support of the body, and in some almost

* Mr. Evans pointed out to me a peculiarity, for which he could see no object, in our skeleton of an Indian Rhinoceros, consisting of two minute incisors scarcely larger than those of a Rabbit, and hardly projecting from the alveolar ; yet these teeth, so small as to be utterly unfit for any useful purpose, are found in every individual of the species. We can only regard these, and all such organs of which the animal kingdom presents innumerable examples, as the characters by which nature distinguishes her various types.

supersede the use of wings. It may be thought difficult to find among fishes a terrestrial type; but as water is the natural element of this class, so the ocean is its metropolis; and those kinds that are confined to rivers and the interior of continents may be safely looked upon as more terrestrial than the rest, and consequently so far equivalent in their habits to rasorial birds; and, while there is no instance of rasorial birds possessed of aquatic habits, or, as Swainson observes, "frequenting water or even its vicinity,"* so no species of *Cyprinidæ* is known to belong to the sea. In India the *Cyprinidæ* are exclusively confined to fresh water, mostly keeping beyond the influence of the tides, thus evincing a propensity for land analogous to that of Rasores.

35. There is perhaps no point better settled in comparative anatomy, than that the pectorals of fishes represent the upper extremities of the higher classes of animals; short pectorals may therefore be said to be equivalent to short wings in birds; but it is a question of much interest to determine fully how this applies to the case before us, and if it is to be relied upon as a true analogy.

In the Frog and several reptiles the scapula has been found by Cuvier and Geoffrey to be composed of two osseous pieces, agreeing with the two upper bones of the posterior frame or jamb of the branchial aperture in fishes, and a third or lower bone assists in forming a girdle to which the pectoral fins are fixed in *Siluridæ* and most fishes of the same order, with the exception of the *Cyprinidæ*, and particularly the herbivorous section of the family (*Pæonominæ*). These bones were found by the most satisfactory analysis to represent the humerus, or bone which gives support to the third row of quill feathers in birds. Below this bone there is a stylet, which in Cyprins is *merely rudimental*. It was found by Cuvier to represent

* Geog. Dist. and Class. of Animals, p. 259.

the ulna and radius, or, in other words, to be equivalent to the cubitus or bone which sustains the secondary quills in the wings of birds.

36. Thus, two bones which in birds constitute the larger portion of the wing, may be said to be almost deficient in herbivorous Cyprins, though they are more developed in many species of the carnivorous section of the family, and still more complete and uniform in other families of the same order, as *Siluridæ*.

37. It is hardly necessary to enter into farther analysis to prove that the pectorals of *Cyprinidæ* in general, but particularly of herbivorous Cyprins, are less complete than those of neighbouring groups; for we are at once struck with the fact, on observing the small size of the pectoral fins in all our *Pæonominæ*, and the slenderness of the rays of which they are composed; while the large clumsy rays of the ventrals, and the strength of these fins, are circumstances that cannot be overlooked, and which, when viewed in comparison with the strong and fully developed legs of *Rasores* (34) supply all that is essential in the analogies between the groups in question.

38. In the most carnivorous species of *Sarcoborinæ* on the other hand, and especially in some of the Opsarions, as *O. polioxus*, and *O. pholicephalus*,* remarkable instances are observed of excessive development in the pectoral fins, and this is always as far as I have seen, attended with a proportionate want of size in the ventrals, which are so slender and small in this genus, and their structure so delicate, as to render it hardly possible to conceive that they can be of much use in aiding the movements of the body. Now the widely cleft mouth or beak, great breadth of wings or pectorals, obsolete ventrals or feet, are common to Opsarions and Fissirostres, so that the first would thus

* t. 47, f. 2, 3.

appear to be a natatorial type of *Sarcoborinæ*, corresponding with that type in the order of perching birds. To this however there is some objection, for if the *Sarcoborinæ* represent the *Feræ*, the most carnivorous genus of the sub-family (which Opsarions would seem to be) ought to represent the *Falconidæ* in which there is only one genus (*Gypaëtus*) remarkable for short feet and great breadth of wing; but the cruel habits and voracious appetite of the Opsarions go to establish this last as the true analogy; this however as well as many other points must remain to be decided by further inquiry. In the mean time we may be justified in the conclusion that the *Feræ* among the *Mammalia*, and the *Falconidæ* among birds have their representatives among the *Cyprinidæ*, and that the same type in each of the three groups seems to possess certain corresponding characteristics which may distinguish them from all adjoining groups, and that in describing those characters, the same terms are as applicable to the one as to the other, which is quite sufficient to prove their corresponding analogies.

39. It may be objected to by those who have not paid much attention to the subject, that detached comparisons of this nature are of little value; still, they are important as the means of directing attention to characters that would otherwise be liable to be passed over unobserved, I am therefore disposed to pay little regard to such objections. The number of species and groups are now so much multiplied in every department of natural history, that detached descriptions are daily diminishing in value; and, besides, it is so easy to make a new genus if not required to shew our reason for doing so, that we need not be surprised that it should now have become a regular trade, and that many acquire a temporary fame with the unthinking part of mankind by the practice.

40. The first test of a natural group is the circularity of its contents. To ascertain whether the affinities of the *Cyprinidæ* are circular, it is

necessary to recollect that the herbivorous Cyprins are characterised by their plain colours and great length of intestinal canal, which varies from six to twelve lengths of the body in the different groups; those with the shortest (the Barbels) intestine being in the centre of the sub-family, it follows that the two extremes must meet, or shew a tendency to approximate or close. The herbivorous Carps are united to the *Sarcoborinæ* by means of the Gonorrhynchs and Systoms, and shew like the last a tendency to form a circle of themselves, though it is probable that the group is yet far from being complete. The *Sarcoborinæ* and the Loaches are united by two new types, the *Platycara* and *Psilorhynchus*; and the *Schistura* in addition to approximating to the *Platycara* unites, or shews a tendency to unite both in form and habits with the *Pæonominæ*, the group with which we set out; thus exemplifying the first principle of natural classification, namely, that every natural series of beings in its progress from a given point, either actually returns, or evinces a tendency to return again to that point, thereby forming a circle.*

41. The second test of a natural group relates to the number of its types. On this point there exists some difference of opinion among writers on the natural system, which their profound inquiries are now doing much to remove. It is a question which, to understand sufficiently for practical purposes, requires an extensive knowledge of natural history, and a mind somewhat more imbued with the spirit of philosophy than has hitherto been considered requisite in those who ventured to name new genera. It has already been said that the lower jaw of the Labeos agrees with that of the Cirrhins, in being formed of two bones articulated behind to the anterior process of the preoperculum, and that in front a transverse

* Swain. Nat. Class. and Geog. Dist. Anim. 224.

apophysis is given off on either side, so as to meet nearly in the middle, where they are united by ligaments and muscles at the chin, which is square, with a fissure in the middle.

The lower jaw of the Barbels is composed of two longer limbs (Fig 6, Plate 54) articulated behind as in the Cirrhins, but without transverse apophyses in front, where the two bones are united by symphysis, or close union firmly cemented as it were with cartilage.

In the Gudgeons the chin is rounded horizontally without the depression in the middle observed in that of the Cirrhins, or the acute lengthened apex of the Barbels, and is composed of a solid bony rim formed of a transverse process directed from each corner of the mouth to the centre, where it is firmly united to its fellow by symphysis at the chin; at the corners of the mouth these transverse processes turn backwards at right angles (as in *Cyp. bata*, Buch. Fig 3, Plate 54) and sometimes at still greater angles as in (Fig 2, Plate 54) *Cyp. mrigala*, Buch. This last process is articulated behind to the anterior process of the preoperculum, and corresponds with Cuvier's angular bone in the Perch.

42. The angular transverse processes in this last form have every appearance of being two distinct pieces (*c.* and *d.* Fig. 2, Plate 54) consolidated in adults by a bony union at the corner of the mouth, yet formed from distinct centres of osseous deposit. Now as these three forms are each attended with peculiar traits of character in regard to the nature of food and the manner of obtaining it, as well as in the structure of their digestive organs, we may be sufficiently justified in regarding them as characterizing three types which, if we like, we may term primary. This view is farther supported by the fact that, to one or other of the three forms in question, variously modified, the lower jaw of all the Cyprins of this country may

be referred. In *Cyprinus semiplotus* (Fig. 1, Plate 54) the angular process is merged into the transverse, the first being only distinguished by the pterygoid process (*c.* Fig. 1, Plate 54), which we know from all the other species examined to belong to the angular limb (*d.* Fig. 2, Plate 54) and not to the transverse process on which it is in this species placed, while the analogy to the type of the Gudgeons is preserved by an additional transverse bone being placed parallel to, and in front of the first (*e. e.* Figs. 1 and 2, Plate 54.) Of the positive value of these characters, I may mention that *Cyprinus mrigala*, Buch. is indicated by Cuvier as a *Cirrhinus*, but proved by this method of analysis to belong to the Gudgeons (*Gobio prop. J. M.*) having as well as the peculiar affinity here pointed out, the lengthened alimentary canal of that genus. *Cyprinus prop. Cuvier*, I suspect will be found according to these principles to agree in its natural affinities either with the Barbels or Cirrhins, as the length of the dorsal and the presence or absence of a spinous ray are scarcely sufficient distinctions even for a sub-genus; and the Catastomi and Labeos of America will, I presume, be found to arrange themselves naturally with the Cirrhins.

The lower jaw of the Gonorhynchs is composed of two limbs placed nearly parallel to each other, and as in the Cirrhins not united in front, but with this peculiarity—that the os hyoides is prolonged to the chin, at which situation the anterior extremities of the three bones are tied together with ligaments.*

In the Opsarions, and generally throughout the *Sarcoborinæ*, the second form of jaw prevails, with the addition of being more acute at the symphysis; this form also seems to prevail in the *Cobitinæ*, but in these the

* Vide Jour. As. Soc. Beng. 1835. p. 40, where I described this structure in *Gonorhynchus petrophilus*.

bones of the jaw are soft and flexible. The limbs of this organ are round and slender in *Cobitis prop.*, but firmly united in front by means of two expanded apophyses, while in *Schistura* they are flat and obliquely inclined to each other, so as to form by means of their inner edges a lengthened symphysis.

43. Thus we appear to have three primary types; the first distinguishes the Cirrhins, Labeos, and probably Catastoms; a second is peculiar to the Barbels, Opsarions, and numerous other genera; and a third is seen in the Gudgeons. From these three types being so prominently developed in the *Pæonominæ*, while one principle chiefly seems to run through all the *Sarcoborinæ*, it is perfectly legitimate to conclude even from this circumstance alone, that the former should be the most perfect group of the two, and that its species should consequently be endowed with more diversified instincts; hence, although a vegetable regimen is the great characteristic of the *Pæonominæ*, still many of the species are omnivorous, and this is to be expected, especially among the Cirrhins and the true Carps (*Cyprinus prop.* Cuv). The Barbels, however, as well perhaps as the Breams which appear to be peculiar to Europe, seem to partake more of carnivorous habits, and therefore must be held as the sub-typical, while the Cirrhins are the typical*, and the Gudgeons and Gonorhynchs from their possessing in the greatest perfection the single instinct for a tendency to which the *Pæonominæ* are most remarkable, viz. subsisting exclusively on a vegetable regimen, are as unquestionably the aberrant forms of *Pæonominæ*; on the other hand the rapacious habits of the *Sarcoborinæ* mark them so conspicuously as a sub-typical group, corresponding as they do with the habit of that group in devouring other animals, that it is unnecessary in this place to offer a remark in support of a fact so plain.

* The Cirrhins being the most perfect forms of a typical group, are strictly, in the language of Mr. Swainson, *pre-eminently* typical.

44. The consideration of the third or aberrant group in *Cyprinidæ* involves some points which will not be so clear to those who have not studied the principles of natural classification. This group should possess three types, and these should be so related as to form a circle of affinities among themselves. This property has suggested the following proposition to Mr. Swainson, which tends to reconcile some diversity of opinion that formerly prevailed as to the number of primary types—"The primary circular divisions of every group are three actually, or five apparently." The three aberrant types are named by Mr. Vigors (Lin. Transac. vol. 14) from the corresponding groups in ornithology, natatorial, suctorial, and rasorial.* The third type I find to be represented by the Loaches, but before we enter into a consideration of that part of the subject, it is necessary to point out the two first types which I have already only alluded to; this I must do by entering into more particulars than may seem to be necessary.

45. Buchanan in defining his ninth division of the old genus *Cyprinus* which is composed of Gonorhynchs, as I have already pointed out, gave them the barbarous name of *Garra*, and compares their habits to those of the Loaches, and observes that they are called *Balitora*, or sand-diggers, by the natives; a name I may observe which in Assam, and I presume also in Bengal, is applied to Loaches only. Indeed the Gonorhynchs, or *Garra* of Buchanan are peculiar to mountains, from whence they are driven down during floods, and do not extend beyond the rapids that skirt their base, so that they can scarcely be said to be entitled to any Bengal name. In this group Mr. Gray detected a new genus, to which I wish he had given a more appropriate name than *Balitora*; for independently of the

* As these terms have been applied conditionally by Mr. Swainson to *Mammalia*, I need make no apology for following the example of so good an authority in applying them to fishes. Indeed I have been guided entirely by the views of Mr. Macleay, as exhibited in the Linnæan Transactions, and the works of Mr. Swainson from beginning to end of this paper.

species being different from any of those described by Buchanan, and supposed by him to be the *Balitora* of the natives, Mr. Gray's genus is peculiar to mountain torrents, the beds of which are usually rocky rather than sandy; for this reason as well as from the fact of the *Balitora* of Gray forming a new type distinguished by a flat head and other remarkable characters, I propose for it the generic name *Platycara*.* Several specimens of this genus, corresponding I suspect with the spotted species of Gray, *P. maculata*, Plate 49, fig 2,† were brought down from Bouton by Mr. Griffith, but they were unfortunately in such a decayed state when opened, that we have been unable to obtain from them a very full specific description. I have however from these specimens been able to satisfy myself on other points connected with their structure, and find not merely that they are distinct from the Gonorhynchs (*Garra*, Buch.) in consequence of their short fleshy abdominal tube which does not, including the stomach, exceed the length of the body, while that of the Gonorhynchs is equal to eight lengths of the body, but that their broad and blunt head is more like that of a *Silurus* than a *Cyprinus*. Their character is rendered still more remarkable by the great breadth and position of the pectorals situated almost beneath the eyes, and the fleshy pedicles or arms on which they are placed, are decided analogies to natatorial forms. If we compare the characters of the *Platycara* with

* From *platus* broad and *kara* the head.

† From the importance here given to these species as forming a new type, I have transferred the two figures from Hardwicke's Illustrations in which there is no description of them, to Plate 49.

Since the above was written the collectors employed by my friend Mr. Griffith in the Kasyah mountains have obtained an additional species, and as their liberal employer has no object to serve beyond the interest of science, he has freely permitted me to make use of this or any similar object of zoological interest contained in his collections. The species alluded to, *P. nasuta*, is described in Prinsep's Journal of the Asiatic Society for November, 1838. Pl. 55, f. 2. See also Pl. 57, f. 2, of this paper; in this species the pectoral pedicles are very slightly developed.

those of the natatorial types in the other classes, we are struck with the analogy—"a blunt truncated muzzle, an obtuse head with strong jaws for seizing animal food." The short intestines of the *Platycara* prove their habits to be carnivorous, and though the mouth is not very large the jaws are remarkably strong, composed as in the Gudgeons of two limbs soldered in the middle, but much stronger than in the instance referred to. Among birds, the Owls—the natatorial group of Raptores, and the Fissirostres in the circle of perchers, as well as most of the Natatores are distinguished above other birds for their breadth of wing, and the blunt or flattened form of the rostrum or the head, as has been proved by the philosophical analyses of the class by Vigors and Swainson.*

46. For the next, or suctorial form (Plate 50, f. 1, 2,) we are indebted to two drawings in Buchanan's collection, which are marked "*Stolephorus*," but the Stolephore (*Engraulis* Cuv.) or Anchovies, belong to the *Clupeidæ*, a family remarkable for its narrow or compressed forms. The two figures referred to are not compressed nor sharp beneath, so that they could not belong to the genus Buchanan had in view when he named them on the drawings, and this mistake he seems afterwards to have corrected, as the same two species appear unquestionably to be those described in the Gangetic Fishes, pp. 347-8, under the names of *Cyprinus Sucatio* and *Cyp. Balitora*.†

The muzzle of these species is remarkably flattened and thin, but there is nothing remarkable about the pectoral fins, and the eyes instead of

* The *Pæciliariæ* Schn. to which I have added a sub-genus *Aplochelus*, as well as the adjoining genera with flat heads and teeth, I also refer to the same type. Plate 42, figs. 2 3. Plate, 55, f. 4.

† It was probably Buchanan's descriptions of these species Mr. Gray had in view when he bestowed the name *Balitora* on the genus which I now call *Platycara*.

being placed on the upper surface of the head as in *Platy cara*, are situated on its edges; the mouth is remarkably small, placed far behind the long and thin muzzle, without any appearance of cirri as in the Loaches, to which Buchanan supposed them to bear a resemblance. This genus which appears to be the suctorial type, I propose to name *Psilorhynchus*.* The peculiarities just noticed, as well as the position of the eyes which are far back in the head as we see in the Moles, Ant-eaters, and other analogous types among quadrupeds, together with their well formed and fully developed fins, indicative of powers of rapid motion, such as distinguishes the Humming-birds, Cinnyris, Waders, and other suctorial types in the same class. Unfortunately we are not acquainted with the habits of the two interesting species under consideration, farther than that they were obtained by Buchanan in the northern parts of Bengal, to which they have been probably swept from the mountains. The information to be derived from their intestines is however of the less importance as affecting their type, as they would be equally suctorial whether they derived their food from the juices of plants or from-shell-fish or ova.

47. It remains to notice the analogical relations of the Loaches, an exceedingly numerous group in India, many species of which are common in every pond throughout Bengal and Assam. In these fishes we shall find the characters of rasorial birds as well as quadrupeds so strongly depicted as to leave no doubt of their forming an equivalent type among *Cyprinidæ*.

When noticing the difference between the true Loaches (*Cobitis*) and *Schisturæ*, I omitted to mention that in the dissections of five species of the former—all I have had an opportunity of examining, I could find no natatory

* From *psilo* thin or attenuated, and *rynchus* a snout or beak.

bladder, while in the only species of the latter which I have been able to inspect I found that organ, though small and peculiar in its form, yet sufficiently developed to lessen considerably the specific gravity, enabling the *Schisturæ* to swim with facility, though perhaps with less buoyancy and ease than other *Cyprinidæ*.* But if a natatory bladder exists at all in the true Loaches (*Cobitis prop.*) or those whose caudal is entire, it must be in the manner described by Schneider—very small and enclosed in a bony bilobate case which adheres to the third and fourth vertebræ, but even in this rudimental shape I have been unable to find an air vessel in any Indian species yet examined.†

This peculiarity, together with their small and weak fins, as well as lengthened and cylindric form, approaching to that of the *Muraenidæ*, afford satisfactory evidence that they are less adapted for swimming than any other *Cyprinidæ*, and may therefore be said to be more terrestrial in their habits, living chiefly on sandy and muddy bottoms, or in jeels amidst aquatic vegetation.

* *Schistura dario* and *geta* have a membranous air vessel placed in the upper part of the abdomen as in ordinary Cyprins, but it consists only of a single lobe. *S. dario*, Buch. is the only species of the Linnæan genus which I have found to frequent deep waters in the open channels of the Ganges and Bramaputra.

† Since this was written, I have found the air vessel in all these species situated in a small bony case immediately over the entrance of the œsophagus from the mouth. Plate 56. f. 5, is a magnified representation of the organ (which is not larger than the head of a pin) as it occurs in *Cobitis guntea*, Buch. and other neighbouring species of the same sub-genus. Fig. 4, Plate 56, represents the same organ in several of the smaller *Schisturæ*, in which it is also placed over the entrance of the œsophagus, and in both cases probably answers the purpose of the branchial or pharyngeal teeth in the *Pænomiæ*, especially as the external surface of the bony crust which surrounds the air-vessel is, as represented in the figures, studded with minute spines.

How nicely does all this correspond with the character of rasorial birds and quadrupeds given by Swainson! "Their toes are never united so as to be used for swimming, a peculiarity which confines them to dry land or to climbing among trees." "This is the type," says the philosophical observer just alluded to, "so remarkable for the greatest development of tail, and for those appendages for ornament or defence which decorate the head. If we went through the whole class of birds, and selected those beginning with the Peacock, wherein the tail was most conspicuous either for its size or for the beauty of its colours, we should unknowingly fix upon those birds which analysis has already demonstrated to be rasorial types. The same results would attend a similar selection of quadrupeds and of winged insects; all these collectively would furnish many hundred proofs by which the uniformity of this type is preserved; appendages to the head, whether in the shape of horns, crests, or fleshy protuberances are no less a prevalent character of the group now before us."*

48. These peculiarities will be found exactly to apply to *Cobitis prop.*, which I shall now prove.

First with regard to tail, the Loaches are the only group of *Cyprinidæ* in which the caudal is not bifid or divided by a fissure into two lobes, reducing its size and power as an organ for propelling the body forward; and on the tails of several, especially *Cobitis pavonacea*, J. M.† we have even the zoned or eye-like spots exactly resembling those of the Peacock, although no instance of the kind is to be found in any other group of *Cyprinidæ*; and in all

* Geog. Dist. and Class. Quad. 258.

† Pl. 52. f. 1.

Loaches the caudal is barred and otherwise ornamented, while that of every other species in the same family is perfectly plain.*

Next as to soft appendages to the head, the Loaches surpass every other group in the same family in the number and uniformity of these appendages; and lastly, the Loaches and *Schisturæ* present the very extraordinary relation to the tribe of ruminants, and especially to the *Cervidæ*, or stags, in having articulated to the orbitar process of the frontal bone on either side, a formidable horn which can be raised at pleasure from a suborbitar sinus analogous to the suborbitar sinus in Antelopes, the use of which in them is conjectural. The horn which is concealed in this sinus in the Loaches, appears to be equivalent to the suborbitar chain in the Perch, and to the corresponding plates in the ordinary *Cyprinidæ*; it is somewhat flattened or palmated, as in many of the Deer tribe, ending in a sharp point which is directed forward; on the anterior margin and near the base of the horn a strong antler is given off, this is also very sharp, and turned forward like the point of the horn itself.

49. I have shown that *Cyprinidæ* is a natural group, that it is circular† in its affinities, that for instance in setting out from the Gonorrhynchs we

* This, as well as all similar analogies afforded by the structure of *Cyprinidæ* were developed in the course of my examination of species before I had ventured to form any general views on the subject, and even before I had studied those of Mr. Macleay, or perused the works of Mr. Swainson, which have taught me the importance of characters which although noted, I felt totally at a loss how to use.

† “They might as well be called oval or square.” “Why not linear?” The researches of zoologists during the last twenty years have fortunately left me nothing original to say in reply to this criticism, which perhaps deserves notice as coming from a member of the Committee of Papers, Mr. C—. Speaking of describing natural objects in the order in which they succeed each

pass through a succession of species connected together by direct relations, and after arriving at an opposite point (*Opsarius*) at which the forms, habits, and

other in nature, Cuvier and Valenciennes observe, "he alone could build up such a pretension who would attempt to place animated nature on a single line, a project which we have long since renounced as one of the most false that could be entertained in natural history."—*Historie Naturelle des Poissons*.

On the same subject, another authority observes—"The day is now happily gone past when zoologists thought that the infinite variety of animals which inhabit this globe owed their origin to the unsuccessful efforts of nature before she could attain the human structure as her term of perfection."—*Macleay—Lin. Transac.*

"As to the rule of natural progression, is it linear? The idea of a simple scale in nature had long been discussed and finally abandoned."—*Swainson's Discourse on the study of Natural History*.

As all natural objects have three relations of affinity, it is clear the chain that connects them cannot be straight, and not being straight the next simplest form is circular, but there is no objection to the progression of affinities being square or oval, provided they can be proved to be so; it is less the form than the circumstance of the opposite extremes of a natural series meeting, that is insisted on.

Some notion of circular affinities appears to have existed from an early date. Hermann in his *Tabula Affinitatum Animalium*, published in 1783, as Mr. Macleay points out, refers to an earlier writer who, like himself, seems to have had a glimpse of the same truth. *Lin. Transac.* vol. 14, p. 49. M. Lamarck detected the existence of a double series which setting out in opposite directions from a given point met together at another. Unacquainted with the result to which Lamarck had been led, Prof. Fischer in 1808, perceived a tendency in the series of affinities to form a circle; but these obscure intimations were first established by analyses in the *Horæ Entomologicæ* of Mr. Macleay published in 1819. Since then Mr. Vigors submitted a general analysis of the whole class of birds to the Linnæan Society, in all the groups of which he found the affinities to confirm what had been observed by Mr. Macleay during his examination of insects, as well as the views contained in a subsequent publication recorded in the Linnæan Transactions, in which the same principles were applied by Mr. Macleay to the whole animal kingdom. The birds of New Holland were subsequently examined by Messrs.

structure differ totally from those with which we set out, we are led back again through a succession of different forms from those through which we passed at first, to the point from which we started.

It has resulted from Mr. Macleay's views applied to the analyses of the classes of birds, quadrupeds, and insects, that "the contents of such a circular group are symbolically (or analogically) represented by the contents of all other circles in the animal kingdom," but as such analyses have not yet been carried through fishes and reptiles, the conclusion just quoted has been submitted rather as a proposition by the distinguished author of the geography and classification of animals whose next proposition is, "That the primary divi-

Vigors and Horsfield with the same result (vide Linnæan Transactions, vol. 16) and the whole of these observations have since been confirmed, and their results more fully made out by Mr. Swainson, who also has extended his views to the *Mammalia*. About the same period with the publication of the *Horæ Entomologicæ*, the progression of affinities began to acquire additional interest among botanists. M. Agardh and M. Decondolle both published their views on the subject, the first in his *Botanical Aphorisms*, and the second in the *Memoires du Museum*; when, without knowing what had been done by Mr. Macleay, Mr. Fries announced the same results in the *Fungi*, attained by a different form of analysis. Similar views have since been more extensively applied to plants by Professor Lindley in the last edition of his *Introduction to the Natural System*.

Writers on natural history in the present day may be divided into three classes; first, those who recognise no rules but such as appear to be laws of nature, and taking nature as their guide form their views according to the result of observations which are not confined to external characters, but embrace all that concerns natural objects. The second class consists of naturalists who pursue the easier course of following authorities, but their works consist chiefly of technicalities derived from external characters indiscriminately applied to genera and species; their higher groups are consequently constructed according to rule rather than nature. The third class comprises describers of species, whose books are only remarkable for their size and expense. Nor can I altogether overlook upon this occasion another class of persons, who, though they are not naturalists, and scarcely even allow us to call them writers, yet exercise but too often an influence in Societies detrimental to the objects of such institutions, and the real advancement of science.

sions of every group are characterised by definite peculiarities of form, structure, and economy; which, under diversified modifications are uniform throughout the animal kingdom, and are therefore to be regarded as the *primary types of nature*." I shall now merely copy from the work referred to, one of the tabular views of the parallel relations of well known groups of *Mammalia* and birds, adding in the first column what appears from my analysis of Indian *Cyprinidæ* to be equivalent groups, and thus shew at once how far this family of fishes is calculated to exemplify the great leading principles of analogy discovered by Mr. Macleay.

<i>Fam. of Cyprinidæ.</i>	<i>Analogical Characters.</i>	<i>Orders of the Mammalia.</i>	<i>Orders of Birds.</i>	<i>Tribes of Insectores.</i>
<i>Typical.</i>				
PÆONOMINÆ, ..	{ Pre-eminent in their powers of prehension, and in general organi- zation—claws, spines, or nails not acute. .. }	QUADRUMANÆ, ..	INSESSORES, ..	CONIROSTRES.
<i>Sub-typical.</i>				
SARCOBORINÆ, ..	{ Rapacious, feeding upon live animals— claws, or other organs of torture acute. . . }	FERÆ, ..	RAPTORES, ..	DENTIROSTRES.
<i>Aberrant.</i>				
<i>Natatorial.</i>				
PLATYCARA and PÆCILIANÆ, ...	{ Head or rostrum flat and large, anterior ex- tremities more de- veloped in proportion than the posterior— habits carnivorous. .. }	CETACEA, ..	NATATORES, ..	FISSIROSTRES.
<i>Suctorial.</i>				
PSILORHYNCHUS, ..	{ Sizediminutive, upper jaw, mandible, or snout prolonged, --run, fly, or swim very fast. }	GLIRES, ..	GRALLATORES, ..	TENUIROSTRES.
<i>Rasorial.</i>				
COBITINÆ, ..	{ Head ornamented either with horns or soft appendages—ha- bits granivorous or herbivorous. .. }	UNGULATA, ..	RASORES, ..	SCANSORES.

50. It would be too much to expect from the materials of one zoological province to demonstrate satisfactorily all the properties of natural groups in the minor divisions of this family. That its typical and sub-typical groups are circular is plain enough, from the diminution in the length of the intestinal canal we experience in passing from the Cirrhins to the Barbels; and again, from the Barbels through the Gonorhynchs to the Gudgeons that canal becomes longer, indicating an union between the latter, and the group from which we set out.

The same thing is observed in passing from the Systoms through the Opsarions,¹ Perilamps, and Leuciscs; a tendency between the former and latter to unite is indicated, thus forming the sub-typical group (*Sarcoborinæ*) into a circle.

A similar thing may be seen in the aberrant group (*Apalopterinae*) in which the *Schisturæ* form one extremity, and the *Platycara* the other; the intermediate space being occupied with the *Pæcilianæ*, *Psilorhynchi*, and true Loaches. The entire caudal of the former points out their relation to *Cobitis prop.*, but until analysis be extended to all known species, European and American, the attempt to reduce the smaller groups to any thing like precision would be difficult and uncertain, from the greater chance there is of the series being less complete than in the higher groups, of which we might always hope to possess at least a specimen of each genus. I shall therefore content myself with having submitted the preceding tabular view of the principal group, referring to the elucidation of genera for further details, in the confident expectation that what has already been demonstrated will induce naturalists to investigate the subject from the materials of other countries as well as of this.

We are far from being prepared to point out the most characteristic types even of our Indian groups of this family. Indeed there may yet

be some unexpected forms unknown to us, the discovery of which would necessarily derange any attempt we could now make to trace in farther detail the parallel relations of the minor groups among themselves. Six species collected in the mountain streams at Simla by Dr. MacLeod, and obligingly submitted to me, have proved to be all undescribed, and one of them affords the type of a new genus *Oreinus*, or mountain Barbels, of which I had before received from Mr. Griffith a species from Boutan (*O. guttatus*); but as there was but one specimen in Mr. Griffith's collections, and that considerably injured, I hesitated to form from it alone the characters of a new group.* This genus has the form of *Gonorhynchus*; the mouth is situated in like manner under the head, but the alimentary canal is considerably shorter, and the dorsal is preceded by a spine as in the Barbels.

51. I am uncertain as to the habits of the European Breams, not having examined them myself; but from all that I can glean on the subject, they appear to be insectivorous, and in the best figures I can find of them the mouth appears to be directed upward, and the anal fin to be long; these characters may prove to be analogies rather than affinities to the Perilamps, and until the point be decided, the parallel relations of the two groups cannot be made out; the only Indian Bream I am acquainted with (*Cyp. cotis*, Buch.) has the character of the Perilamps both in the form of its mouth and length of its alimentary canal, while on the other hand, the old genus *Leuciscus* is not a natural group, some of the European species, as *Cyprinus Cultratus* being doubtless an *Opsarius*,† while others are certainly her-

* *Cyprinus Richardsonii* figured in Hardwicke's Illust. t. 94. f. 2. is an *Oreinus*, and may be appropriately named *O. punctatus*.

† *Leuciscus Cæruleus*, Yarrel and *L. erythrophthalmus*, Cuv. appear to be Perilamps, *L. doubla*, *L. lcancastrimensis*, Yarr. and *L. alburnus* are also insectivorous. I have mentioned this in a letter to Mr. Swainson in October last, and I have no doubt the hint will be sufficient to direct the attention of this philosophical naturalist to an examination of the whole of the English species.

bivorous,* and might perhaps be referred to the Gudgeons; but until all these points be settled, it would be idle to dwell farther on the parallel relations between the typical and sub-typical groups.

52. *Cyprinidæ*, of all fishes of equal importance are those that appear to have occupied least, the attention of naturalists; a circumstance the more curious, as in consequence of their being peculiar to fresh waters they are more universally distributed in the interior of continents, where they ought to be more familiar and useful to man than any other family of the same class.

Regarding their distribution, little has hitherto been made known. It would not appear that there is any one species common to Europe and America; it is not however to be supposed that we are yet prepared to form an accurate comparison between the *Cyprinidæ* of the old and new worlds, since the majority of species in either seems as yet to be but ill defined. Nor is it to be supposed that ichthyology has yet been prosecuted in America to an extent at all likely to make us acquainted with the numerous species that must inhabit the extensive lakes and rivers of that continent. Of African species few only are referred to by Cuvier, while the Nile is known to present some species that are not found in the south of Europe. The Chinese species may yet be said to be almost unknown, with the exception of a few determined by Cuvier from the very doubtful data afforded by paintings; although it is seldom that so favourable an opportunity is afforded for collecting information on any branch of natural history, as that which the British embassies in China possessed, for investigating the peculiarities of the fresh water fishes of that empire, from the length of time they passed in boats on some of the principal rivers. Nor is any thing whatever known, as far as I am aware, of the existence of Cyprins in New Holland or any

* *Leucis vulgaris*, *L. idus* and *L. rutilus* are probably herbivorous, and according to the length of their intestine may either be added to one or other of the groups here indicated.

of the Polynesian Islands.* In India the fishes of several of the great rivers yet remain to be investigated, as those of the Irrawaddi, the Indus, and the Nerbudda. A collection of drawings of the fishes of the Indus, prepared during a scientific mission under Capt. Burnes, has recently been deposited in the museum of the Asiatic Society; and Mr. Griffith, to whom every branch of science is as dear as the one in which he is fast rising to the highest station, is now engaged in making extensive collections of, and observations on, the fishes of the same river. The museums of Paris must already be well stored

* This and other blanks in our knowledge of the animals of New Holland are now about to be supplied by Mr. Macleay himself, who, in August last, embarked with the intention of pursuing researches in every department of the natural history of New Holland. On his departure from England, Mr. Macleay intimated his desire to receive at Sydney, where he may remain for three or four years, Insects, Crustacea, and other neglected objects of a similar nature from India in exchange for the productions of New South Wales, which he would be happy to supply: Few who entertain a just pride for the scientific character of our country which Mr. Macleay has been the means of elevating, would require the stipulation proposed to induce them to forward the views of one of our countrymen who has already been the means of exalting zoological pursuits to the highest place among intellectual occupations. Considering the intimate intercourse now established between Calcutta and Sydney, it is to be hoped that an appeal to India, from such a quarter, will not have been made in vain, and that all who are interested in the advancement of natural history will collect and forward whatever objects their particular localities may afford, with a view to facilitate the researches of the illustrious author of *Horæ Entomologicæ*. Mr. Macleay writes from London, 12th August, 1838—"I am now on the eve of embarking for Sydney, where I intend to remain for the next three or four years, and what I would ask of you is to exchange invertebrated animals, collected in India, as the Annelidæ, Annulosa, Cirrepedes, Radiata, and Acrita for other objects collected in New Holland; Insects, Spiders, and Crustacea of India I at present desire above all; and shall feel obliged by any notes on their metamorphosis or economy. With regard to such notes, I need not say I shall bear in mind the axiom "*Suum cuique*," if you will point out your particular *desiderata* in natural history I will endeavour to add to your collections."

Mr. Swainson also writes as follows—"At present I am engaged in Ichthyological volumes; but as these will be published before you would have time to render me any

with Indian species collected by Messrs. Duvaucel, Jaquemont, and De-Lessert, but I doubt if any of our British museums contain many of the commonest species of the Ganges.

Natural history is now assuming a station so important in the highest scale of intellectual pursuits, that any remarks at all calculated to impress on the minds of those who are connected with missions into new countries a lively sense of the interest that attaches to its most minute details, will not, we may be assured, be taken amiss. Information however carefully collected on such occasions as those referred to, becomes comparatively useless when unaccompanied with specimens of the things to which it relates. We should ever recollect that the easiest and best way to promote our own fame, and contribute at the same time to the advancement of natural history, is by making collections, nor are we without examples of the highest awards having been, though somewhat prematurely, conceded to collectors. Nevertheless, to render collections of the highest degree of real value in the present advanced state of science, those who make them should gather at the same time as much information as possible regarding the circumstances under which the various objects comprised in them live, or

assistance, I will rather entreat your aid in the class of Insects which will next succeed in the 'Cabinet of Natural History.' My cabinet is remarkably deficient in the entomology of India, particularly among the smaller and less showy species. The best way of preserving Beetles or coleopterous insects as well as spiders is by putting them into spirits, all other insects should be stuck upon cork." Common bazar spirits answers the purpose of preserving insects very well, if it be strong enough to burn, which it would be well to try always before trusting to it, and instead of cork remarkably light and convenient trays may be made of a common species of *Aeschynomene*, called in Bengal *Sola*, and may be made, so that a number of them fit into a box. The paste with which the *Sola* is fastened might be poisoned, and a little camphor rolled up in thin paper, placed in each tray as a security against ants. I shall be happy to afford my aid to any friends of science in India, by forwarding any collections that may be entrusted to me for the eminent persons who have applied to us.

occur ; and it is in this that the intelligence of the naturalist may be best and most profitably displayed during his journies in new countries.

53. The following tabular view of the distribution of *Cyprinidæ*, though avowedly imperfect, will serve to show how the leading groups are generally dispersed. Cirrhins, for instance, appear to be peculiar to India, or at least to the tropical parts of Asia, and the Catastoms to America ; while both are represented in Europe by the true Carps. From the number of Gangetic species, the Barbels like the Cirrhins would seem to have their metropolis in India, from whence the genus is extended over the Caspian Sea, and the Nile into Europe.

The Gonorhynchs would also seem, as a group, to be natives of the East, one species only having been found in South Africa, none in Europe, and eleven in India.

The greater part of the *Sarcoborinæ* are probably also Eastern fishes, with the exception of the Breams and Lenciscs, although some of the European forms set down under the latter genera may be found to belong either to the Perilamps or Opsarions.

The small sub-genera of *Pæcilia* appear to be equally distributed in all parts of the world, one having been already found in Africa, two species in India, where a few more may be expected, seven species in America, and seven in Europe ; but in every case the species of one continent have been found to be distinct from those of another.

The Loaches (*Cobitis prop. Lin.*) afford another instance of the concentration of numerous species in India, while three only are found in Europe, and none whatever in America. The annexed table exhibits the general distribution of the family.

GENERAL VIEW OF THE DISTRIBUTION OF CYPRINIDÆ.

				ASIA.							
FAMILY,	SUB-FAM.	GENUS.	SUB-GEN.	EUROPE,	AMERICA,						TOTAL.
						INDIA,	CHINA,	CASPIAN,	AFRICA,	UNCERTAIN,	
CYPRINI- DÆ Cuv.	PÆONOMINÆ McClell.	Cirrhinus Cuv...	.. ..	..	—	—	13	—	—	—	13
			Labeo Cuv.	.. ..	—	2	1	—	—	1	5
		Catastomus Leseur,	.. ..	..	—	19	—	—	—	—	19
		Barbus Cuv.	.. ..	..	4	—	11	—	2	1	18
			Oreinus McClell.	.. ..	—	—	4	—	—	—	4
		Cyprinus prop. Cuv.	.. ..	..	6	—	4?	4?	—	—	14?
		Gobio Cuv.	.. ..	..	2	—	16	—	—	—	18
			Tinca Cuv.	.. ..	1	—	—	—	—	—	1
		Gonorhynchus Gron...	.. ..	..	—	—	10	—	—	1	11
	SARCOBORINÆ McClell.	Systemus McClell.	.. ..	..	—	—	12	—	—	—	12
			Abramis Cuv.	.. ..	5	1	1	—	—	—	7
		Rhodeus Agass.	Fossil Genera in the lacustrine deposit of Cœningen.								
		Apius Agass.	.. ..	..	—	—	12	—	—	—	12
		Perilampus McClell.	.. ..	..	—	—	—	—	—	—	—
		Leuciscus Klein.	.. ..	..	13?	4?	9	—	—	—	26?
		Opsarius McClell.	.. ..	..	—	—	12	—	—	—	12
			Pæcilia prop. Schn.	.. ..	—	4	—	—	—	—	4
			Lebias Cuv.	.. ..	1	—	3	—	—	—	4
			Fundulus Lacép.	.. ..	5,	2	—	—	—	—	7
	Pæcilia McClell.	Molinesia Leseur,	.. ..	—	1	—	—	—	—	1	
		Cyprinodon Lacép.	.. ..	2	4	—	—	—	—	6	
		Aplocheilus McClell.	.. ..	—	—	3	—	—	—	3	
			Anableps Bl.	.. ..	—	—	—	—	1	1	
		Platycara McClell.	.. ..	..	—	—	3	—	—	3	
	Psilorhynchus McClell.	.. ..	..	—	—	2	—	—	2		
	APALOPTERI- NÆ McClell.	Cobitis Lin.	{ CobitispropriaMcClell.	3	—	12	—	—	—	15	
			{ Schistura McClell.	—	—	11	—	—	—	11	
					42	37	139	4	2	41	229

The American species of this family referred to in the *Regné Animal*, only amount to thirty-three, but Dr. Richardson in his report on North American Zoology mentions nearly as many more, imperfectly indicated by Rafinesque Smaltz, and other writers as belonging to the rivers and lakes of the new world*;

* I have not yet seen the volume of *Fauna Boreali Americana* by Dr. Richardson, which is devoted to Ichthyology, the volume on Birds being the only part of that important work which has reached India.

still however the preponderance of species in favour of India is so remarkable, that it is only by extending our consideration to other genera of the order *Malacopterygii abdominales* that we find the equilibrium restored in the distribution of fresh-water fishes. Thus the *Salmonidæ* which form a large proportion of that order in the rivers of both Europe and America, are in India quite unknown, not one species of that extensive family having yet been found in this country, where the blank appears to be filled up by the excessive development of the *Cyprinidæ*.

54. One species of Tench,* four Leuciscs,† and one Gudgeon,‡ are enumerated among the fossils of Oeningen by M. Agassiz, who also describes two new genera § *Rhodeus* and *Apius*, nearly allied to, but distinct from the Perilamps and Systoms. They are distinct from the first, by the dorsal and ventral margins being equally arched, and the caudal and anal fins being less developed; and from the second, by the absence of spines in either of the latter fins; both belong however to *Sarcoborinæ*, and will serve to render that group far more complete than it appeared to me to be before I saw M. Agassiz's splendid work. Two fossil species of *Cobitinae* are also found in the same locality, one of these, *C. cephalotus* Agass. belongs to *Schistura*. The marlstone in which these remains are found is justly considered by M. Agassiz to be a lacustrine deposit, and supposed to be coeval with the molasse of Switzerland and the sand stone of Fontainebleau, and consequently to correspond with the miocene or early tertiary period.

* *Tinca leptosoma*, Agass. *Recherches sur les Poissons Fossiles*, vol. v. t. 51.

† *Leuciscus papyraceus*, Agass. V. t. 36. *L. leptus*, Agass. V. t. 57. *L. pusillus* id. l. c. *L. oeningensis* id. and *L. heterurus* id. l. c.

‡ *Gobio analis*, Agass. t. 57

§ *Rhodeus elongatus*, Agass. t. 54. and *R. latior* id. l. c. Of the genus *Apius*, M. Agassiz describes *A. gracilis*, and *A. brongiarti*, V. t. 55.; but the latter as well as *Leuciscus papyraceus* are from the lignites of Mènat.

55. That the external covering of animals indicates the medium in which they live, we know by the hairy coat of the *Mammalia*, the feathers of birds, and the scales of fishes and *Amphibia*. Nevertheless there are several families of fishes without scales, and many terrestrial *Mammalia* that are supplied with them instead of hair. In the naked fishes the body is defended by a copious oily mucous, which saves it no less effectually than scales from the abrasive influence of the dense medium through which they are destined to move, while their habits and form render the necessity for a scaly armour less essential to their safety, being capable of concealing themselves from enemies in sands and mud, as the Rays (*Raia*) and Eels, (*Muræna*), or are of such a formidable character as to render any security against the injuries of their class unnecessary; such are the *Squallidæ* or sharks, which may be said to be predominant among the fishes of the ocean, and the *Siluridæ* which maintain a corresponding place in fresh-water lakes and rivers. Notwithstanding this diversity, M. Agassiz has turned the external covering of fishes to a happy account in the study of fossil species, of which the scales alone are often the only vestiges that remain; thus a knowledge of eight hundred extinct species has been attained that could not have been characterized by ordinary means. Although the researches of M. Agassiz have added largely to the science of zoology, they have done still more if possible for geology, by "introducing a new element" into our calculations;* no one however is more aware than M. Agassiz himself, of the error into which some are led in supposing the lepidermal system to be based on principles that are in any way at variance with the natural classification of animals. By that system M. Agassiz has extended our knowledge of the natural characters of species, and introduced to the calculations of the zoologist as well as geologist, a new element by which we must be guided in the study of fossil fishes, rather than a principle opposed to the classification of these or other animals according to their structure and habits.

* Dr. Buckland's Brid. Treat. p. 270.

Classification
OF
INDIAN CYPRINIDÆ.

Cyprinidæ constitute the first family of the second order of osseous fishes named in the Regne Animal, "Malacopterygii Abdominales," from their ventral fins being placed behind the pectorals, without being attached to the bones of the shoulder.

CHAR. *One dorsal fin, stomach without cæcal appendages, branchial membrane with few rays.*

1. SUB-FAM.—PÆONOMINÆ.* J. M.

CHAR. Mouth slightly cleft, either horizontal or directed more or less downward. The stomach is a lengthened tube continuous with a long intestinal canal. Colours plain. Three rays in the branchial membrane.

OBS. They occur only in fresh water, and comprise a large proportion of the fishes of lakes and rivers, more especially those that are of economical importance. Their food consists chiefly of confervoid plants and other productions of the vegetable kingdom.

* From *Poionomos*, that feeds on herbs.

I. GEN.—CIRRHINUS.

CHAR. Lower jaw composed of two short limbs loosely attached together in front, where instead of a prominent apex, there is a depression ; lips soft and fleshy with four cirri,* dorsal without spinous rays.

OBS. This genus would seem to be represented in America by the *Catostomi* of Leseur, and in Europe by *Cyprinus proprius*, Cuv. In India it affords several of the most favourite, abundant, and wholesome species.

Spec. C. macronotus, J. M. t. 41. f. 1.

Length of the head to that of the body as one to four ; forty-one scales along the lateral line, and thirteen in an oblique line from the base of the ventrals to the dorsum. D.23 : P.16 : V.9 : A.7 : C. 19.

HAB. Assam and North-eastern parts of Bengal, where it attains from two to three feet in length.

Spec. C. nandina, Buch. P. G.† t. 8. f. 84.

Length of the head to that of the body as one to three ; forty-four scales along the lateral line, and twelve in an oblique line from the base of the ventrals to the dorsum. D.26 : P.16 : V.9 : A.7 : C.19.

HAB. Bengal and Assam.

Spec. C. calbasu, Buch. P. G. t. 2. f. 33.

Length of the head to that of the body as one to four and a half ; forty-two scales along the lateral line, and fourteen in an

* I am not sure as to cirri forming any very valuable character of a natural genus. The length of the dorsal fin certainly does not ; in the first species it is as long as in the Carp.

† P. G. These initials refer to Buchanan's work on Gangetic Fishes.

oblique line from the base of the ventrals to the dorsum. D.15 : P.17 : V.9, or 10 : A.8 : C. $\frac{10}{9}$.

Variet. Forty-two scales along the lateral line, and fifteen in an oblique line from the base of the ventrals to the dorsum. D.16 : P.15 : V.9 : A.5 : C. $\frac{9}{10}$.

HAB. Bengal and Assam.

Spec. C. rohita, Buch. P. G. t. 36. f. 85.

Length of the head to that of the body somewhat less than one to three; forty-two scales along the lateral line, and twelve in an oblique line from the base of the ventrals to the dorsum. D.15 : P.16 : V.9 : A.7 : C. $\frac{10}{9}$.

*Variet.** t. 41. f. 2. Forty-three scales along the lateral line, and thirteen in an oblique row from the base of the ventrals to the dorsum. D.15 : P.16 : V.9 : A.8 : C.20.

HAB. Bengal and Assam.

Spec. C. gonius, Buch. P. G. t. 4. f. 82.

Scales minute; snout muscular and perforated by numerous mucous pores. D.15 : P.17 : V.9 : A.7 : C.19.

HAB. Bengal and Assam.

Spec. C. nancar, Buch. P. G. p. 299.

Sub-operculum rudimentary, and concealed beneath the integuments. D.20 : P.18 : V.9 : A.8 : C.19.

HAB. North-eastern parts of Bengal.

* This fish attains a large size in Assam, and is probably the true *Ruee* of the natives. That which is figured by Buchanan is as far as I have seen a small fish, though the larger kind which I have figured would seem to be the one he has described. This as well as the preceding species present so many varieties, probably the result of artificial means resorted to for their propagation, from their value as an article of food, that it is difficult to define their true characters.

The following three species have a black spot at the base of the caudal, and the dark colour of the back descends in fasciated points on the sides, thus indicating a relation with the *Sarcoborinæ*; but until the nature of this relation be determined, and their habits and structure known, I place them with the *Cirrhins*. I only know them by Buchanan's figures and descriptions.*

Spec. Cyp. morula, Buch. P. G. Pl. xviii, f. 91.

Length of the head equal to the altitude of the body, and to a fourth of the length; lips pendulous, the hinder fimbriated.
D.13 : P.16 : V.9 : A.8 : C.19.

HAB. Ponds in Bengal.

Spec. Cyp. joalius, Buch. t. 42. f. 6. β†

Head large and very blunt, mouth low and horizontal.
D.12 : P.—? V.9 : A.8 : C.—?

HAB. North-eastern parts of Bengal.

Spec. Cyp. dero, Buch. P. G. t. xxii. f. 78.

Only two cirri. Head oval and blunt, snout prominent and rough, lips smooth-edged. D.13 : P.18 :—? V.9 : A.7 : C.19.

HAB. Bramaputra.

SUB-GEN.—LABEO.

CHAR. Structure and habits agree with those of the *Cirrhins*, but cirri are wanting, or very minute.

OBS. The last species would seem to be a *Catastomus*, and the two first to be very nearly allied to each other, and to differ chiefly from *C. gonius*, Buch.

* To these may be added for the present *Cyp. pausio*, Buch. P. G. 317. t. 42. f. 4 β. It seems to differ from them merely in being without cirri.

† This sign β, denotes that the figure given is from Buchanan's collection.

in being without cirri. They correspond with the species named by Buchanan, *Cyp. curchius*, *C. cursa*, and *C. cursis*, but I cannot altogether reconcile them with his descriptions; they appear to me to be varieties resulting from domestication.

Spec. Cyp. curchius, Buch. t. 40. f. 3.

Scales minute and disposed so as to indicate longitudinal stripes, lips fleshy and fimbriated, seventy-eight scales along the lateral line, and thirty from the base of the ventrals to the dorsum. D.17 : P.16 : V.9 : A.7 : C. $\frac{10}{9}$.

HAB. Bengal and Assam.

Spec. Cyp. cursis,* Buch. t. 38. f. 3.

Snout thick and projecting, eighty-three scales on the lateral line, and about twenty-seven across the body from the base of the ventrals to the dorsum. D.16 : P.17 : V.9 : A.7 : C. $\frac{10}{9}$.

HAB. Assam and Bengal.

Variet. Cyp. cursa, Buch. t. 38. f. 2. β

Scales and fin rays the same as in *C. curchius*, but the back is more abruptly arched, and the abdominal margin is straight to the anal.

Spec. C. dyocheilus,† J. M. t. 37. f. 1.

Goreah of the Assamese.

Head long, opercular plates covered with thick integuments, snout muscular, forty-four scales along the lateral line,

* This variety had been figured from a dried specimen and transferred to stone, before I found in Buchanan's collection a most excellent drawing of it.

† So called from the pendulous structure of the snout descending so as to form the appearance of a second lip.

and thirteen in an oblique line from the base of the ventrals to the dorsum. D.12:P.18:V.9:A.8:C.19.

HAB. Assam, where it usually attains two feet and upwards in length.

II. GEN.—BARBUS.

CHAR. Lower jaw composed of two lengthened limbs, united in front so as to form a smooth narrow apex. Dorsal short preceded by a strong spine, lips hard, four cirri, intermaxillaries protractile.

OBS. Species of this genus inhabit the Caspian Sea, the Nile, and several of the rivers of Europe, generally confined to clear water. The comparative shortness of the intestinal canal proves them to be less exclusively herbivorous than any other fishes of the same sub-family. The Indian species, indicated in the *Regne Animal*, all belong to other genera.

Spec. B. hexastichus,* J. M. t. 39. f. 2.

Cyp. tor, Buch. P. G. 305.

Lobura of the Assamese.

Length of the head to that of the body as two to seven, twenty-five scales along the lateral line, and six in an oblique row from the base of the ventrals to the dorsum. D.11:P.17:V.9:A.8:C.19.

HAB. Great rivers in the plains of India. Ordinary length from one and a half to three feet.

* From the scales forming six rows along the sides.

Spec. B. progeneius,* J. M. t. 56. f. 3.

Cyp. tor, Buch. Coll.

Length of the head to that of the body as one to three, twenty-six scales along the lateral line, and six in an oblique row from the base of the ventrals to the dorsum, with a large cellular appendage to the apex of the lower jaw. D.12 : P.16 : V.9 : A.7 : C.19.

HAB. Great rivers in the plains of India. Ordinary length from $1\frac{1}{2}$ to 3 feet.

Spec. B. macrocephalus, J. M. t. 55. f. 2.

Bura hetea of the Assamese.

Length of the head to that of the body as two to five, twenty-seven scales along the lateral line, and six in an oblique line from the base of the ventrals to the dorsum. D.11 : P.16 : V.10 : A.7 : C. 19.

HAB. Rapids in Upper Assam. Ordinary length from 2 to $3\frac{1}{2}$ feet.

Spec. B. hexagonolepis,† t. 41. f. 3.

Bokar of the Assamese.

Length of the head to that of the body as one to four, exposed surface of the scales hexagonal, twenty-seven scales along the lateral line, and seven in an oblique line from the base of the ventrals to the dorsum. D.12 : P.16 : V.9 : A.7 : C. $\frac{10}{9}$.

HAB. Upper Assam. Ordinary length from $1\frac{1}{2}$ to $2\frac{1}{2}$ feet.

* From Προγενειος, that has a prominent chin or long beard ; in allusion to the singular appendage to the lower jaw of this species by which it may be easily recognized.

† In allusion to the form of the exposed portion of the scales.

Variet. Cyp. putitora, Buch.

Head small and blunt, with eleven rays in the dorsal, attaining occasionally nine feet in length.*

Spec. B. megalepis,† Hardw. Illust. t. 93.

Cyp. mosal, Buch.

Maháseer of the Hindus.

Body below uniformly arched at the insertion of the anal, length of the head to that of the body as one to three. D.13 : P.17 : V.9 : A.7 : C. $\frac{10}{9}$.

HAB. Northern parts of Bengal. Length occasionally four or five feet.

Spec. B. chelynoides, J. M. t. 57. f. 5. Jour. A. S. vii. t. 56. f. 5.

Head large, lips thick and smooth, thirty-three scales along the lateral line, and nine in an oblique line from the base of the ventrals to the dorsum. D.10 : P.16 : V.9 : A.7 : C.18.

HAB. Mountain streams at Simla. Usual size about six inches in length. Dr. Macleod's Coll.

OBS. The following five species have the dorsal spine serrated behind. The first three are probably varieties of the same species.

* This fish I have been unable to identify with Buchanan's description, I may therefore have described it under another name; he says the head is blunt, oval, small, and smooth, which scarcely applies to either of the foregoing, in which the head is remarkably lengthened; that of *B. hexagonolepis* would come nearest to it, though some of the others seem to correspond more in other respects with the account given. Pisc. Gang. 303.

† From *Mega* large, and *lepis* a scale.

Spec. Cyp. sarana, Buch. P. G. p. 307.

Cyp. kanta, id Coll.

Cyp. kunamo Russ?

Head blunt, oval, and small, with a small bone at either side of the upper lip, green above, below silvery, scales large.
D.10 : P.16 : V.9 : A.8 : C.19.

HAB Ponds and rivers in India. Rarely attaining two feet in length.

Spec. B. spilopholus,* J. M. t. 39. f. 4.

Head much compressed, cheeks and snout perforated with mucous pores, forty-eight scales along the lateral line, and seventeen in an oblique row from the base of the ventrals to the dorsum; each scale marked with a black spot at the base.
D.11 : P.15 : V.9 : A.7 : C. $\frac{10}{9}$.

HAB. Northern parts of Bengal.

Variet. Cyp. chagunio, Buch. P. G.

Scales large and spotted at the base, head much compressed, with numerous prominent mucous pores on its fore part.
D.12 : P.17 : V.10 : A.8 : C.19.

HAB. Northern parts of Bengal.

Spec. B. deliciosus, J. M. t. 39. f. 3.

Head short and blunt, thirty-four scales along the lateral line, eleven in an oblique line from the base of the ventrals to the dorsum, with a bright gold coloured spot on each operculum.
D.12 : P.16 : V.9 : A.7 : C.19.

HAB. Assam. Ordinary size about 10 inches in length.

* From *spilos* a spot, and *pholis* a scale.

Spec. B. rodactylus,* J. M.

Fins red and orange, except the dorsal and upper lobe of the caudal, ten rays in the dorsal.

HAB. Lower Assam. Usual size about 5 inches in length.

SUB-GEN.—OREINUS,† J. M.—MOUNTAIN BARBELS.

CHAR. Head fleshy, mouth vertical, lower jaw shorter than the upper, snout muscular and projecting, furnished with cirri, dorsal preceded by a serrated spinous ray, scales small.

OBS. Intestinal canal and stomach form a tube equal to about four or five lengths of the body, including the head and caudal.

Spec. O. guttatus, J. M. t. 39. f. 1.

Head covered with thick integuments, branchial apertures small, sides and fins irregularly marked with brown spots, scales minute. D.10 : P.17 : V.11 : A.10 : C.20.

HAB. Mountain streams in Boutan, at an elevation of about 5000 feet, where it was found by Mr. Griffith.

Spec. Cyprinus Richardsonii, Gray. Hardw. Illust. t. 94. f. 2.

About eleven rays in the dorsal, and nine in the anal, back speckled with minute dots.‡

* *Rodactylos*, literally rosy-fingered, in allusion to its red fins.

† From *Oreinos*, pertaining to mountains.

‡ This may probably prove to be *O. guttatus*.

Spec. O. maculatus, J. M. t. 57. f. 6. Journ. A. S. vii. t. 56. f. 6.

Mouth situated on the lower surface of the head, small shapeless spots irregularly distributed over the body, but not on the fins, scales minute. D.11 : P.18 : V.10 : A.5 : C.19.

HAB. Mountain streams at Simla, elevated between 5000 and 6000 feet, where it was found by Dr. Macleod.

Spec. O. progastus,* J. M. t. 40. f. 4.

Adoee of the Assamese.

Muzzle fleshy and pointed, lips thick, somewhat pendulous and muscular, abdomen very prominent beneath the pectorals. D.12 : P.13 : V.10 : A.7 : C.19.

HAB. Rapids in Upper Assam, where it occasionally attains 18 inches in length, but its flesh is believed to produce vertigo and other alarming effects on those who use it.

III. GEN.—CYPRINUS PROPRIUS.

CHAR. Body elevated, lower jaw short and rounded in front, lips hard, thick, and without cirri; dorsal long. Dorsal and anal usually preceded by spinous rays.

OBS. Only two species of this group have been as yet found in India, and one of these is without the dorsal and anal spinous rays.†

Spec. C. semiplotus, J. M. t. 37. f. 2.

Sentooree of the Assamese.

Head slightly depressed, with a single row of large mucous pores extending horizontally in front of the snout, back gibbous,

* Προγαστως, that has a prominent belly.

† They have little affinity to each other; in *C. semiplotus*, the head is small and fleshy, so as to conceal the opercular plates, and in *C. catla*, it is large with naked opercula.

thirty-two scales along the lateral line, and ten in an oblique row from the base of the ventrals to the dorsum. D.27 : P.16 : V.9 : A.9 : C.19.

HAB. The rapids of the Bramaputra in Upper Assam. Usual size 1 foot to $1\frac{1}{2}$ in length.

Spec. C. catla, Buch. P. G. t. xiii. f. 81.

Head large, forty-four scales along the lateral line, and fourteen in an oblique row from the base of the ventrals to the dorsum. Dorsal and anal without spinous rays. D.18 : P.18 : V.9 : A.8 : C.19.

HAB. Fresh water rivers and ponds in Bengal and Assam. Ordinary size from $1\frac{1}{2}$ to 3 feet in length, but occasionally it is found twice that size.

IV. GEN.—GOBIO.

CHAR. The dorsal is placed over the ventrals, and like the anal is short and without spines, lower jaw shorter than the upper, and is either round or square in front, lips thin and hard, snout prominent.

OBS. The Gudgeons thus defined are a very natural group, remarkable for the extraordinary length of the abdominal canal. One of the only two indicated by Cuvier from Buchanan's species, is an Opsarion, a genus no less remarkable for the shortness of the abdominal canal than the Gudgeons are for its length; but as the distinctions on which the subdivisions of the family are here made, have not before been observed, we cannot be surprised that it should be repeated in the last edition of the *Regne Animal* from Linnæus, that the stomach of *Cyprinidæ* "is continuous with a short intestine." The following five species have each two cirri.

Spec. Cyp. mrigala, Buch. t. 38. f. 1. P. G. t. 6. f. 7.

Length of the head to that of the body as one to four and a half, depth of the body about one-fourth of the length, forty-four scales along the lateral line, and fourteen in an oblique line from the base of the ventrals to the dorsum. D.16 : P.17 : V.9 : A.8 : C.19.

HAB. Rivers and ponds throughout Bengal and Assam. Ordinary length two feet.

Variet. Rewah of the Natives, t. 58. f. 1.

Head less compressed than the body, upper jaw somewhat prominent, forty-three scales on the lateral line and thirteen in an oblique line from the base of the ventrals to the dorsum. D.15 : P.16 : V.9 : A.8 : C.19.

HAB. Ponds in the vicinity of Calcutta. Length from six to twelve inches.

Spec. Cyp. curmuca, Buch. Jour. Mys. III. t. 30.

Snout prominent and furnished with tubercles or mucous pores, lips smooth, and on each there is a small bone. D.11 : P.16 : V.9 : A.8 : C.18.

HAB. Rivers in Southern India, where it occasionally reaches three feet in length.

Spec. Cyp. reba, Buch. P. G. p. 280.

Head blunt, mouth small and directed downwards, lips soft. D.11 : P.17 : V.9 : A.8 : C.19.

HAB. Northern parts of Bengal and Behar, where it attains two feet in length.

Spec. Cyp. angra, Buch.

Cyp. Hamiltonii, Gray, Hard. Illust. t. 86. f. 1.

Lasseem of the Assamese.

Snout prominent and fleshy, thirty-five scales along the lateral line, and fourteen in an oblique line from the base of the ventrals to the dorsum. D.10 : P.10 : V.9 : A.8 : C.19.*

HAB. Bramaputra.

Spec. G. lissorhynchus.† J. M. t. 55. f. 5.

Cyp. acra, Buch. *Cyp. cura*, id. P. G. p. 284.

Snout smooth and blunt without cirri, thirty-nine scales along the lateral line, and thirteen from the base of the ventrals to the dorsum. D.11 : P.16 : V.9 : A.8 : C.19.

HAB. Large rivers of Bengal and Assam. Usual length six to nine inches.

In the six following species the scales are thin and rough, and generally placed so that each scale is in the axis of the one immediately preceding or succeeding, and not in regular oblique rows as is usual in the family; but this peculiarity is not so well marked in some species as in others. They are all without cirri. See *Cyprinus bangon*, Buch. t. 58. f. 2. β.

Spec. Gobio isurus, J. M.‡

Snout smooth without cirri, scales in parallel rows, with a grey line between each row. D.11 : P.14 : V.9 : A.7 : C. $\frac{10}{9}$.

HAB. Upper Assam, where it attains a size of eight or ten inches.

* Buchanan gives the fin rays as D.11 : P. 18, or 19 : V.9 : A.8 : C.19.

† From *lissor* smooth, and *rhynchus* the snout.

‡ From *isos* equal, and *oura cauda*.

Spec. Cyp. boga, Buch. P. G. t. 28. f. 80.

Snout perforated with numerous mucous pores, lower lip fimbriated, scales raised on either side of the base of the dorsal, lobes of the caudal slightly divided. D.12 : P.—V.9 : A.8 : C.—

HAB. Bramaputra. Usual length about nine inches.

Spec. G. bicolor, J. M. t. 40. f. 1.

Snout smooth, long, and rather pointed, lower jaw shorter than the upper, forty-two scales on the lateral line, thirteen in an oblique row from the base of the ventrals to the dorsum. Blue above, beneath silvery, pectorals small. D.12 : P.16 : V.9 : A.7 : C.19.

HAB. Rivers on the northern side of Assam. Griff. Coll.

Spec. G. anisurus,* J. M. t. 40. f. 2.

Snout blunt, lower jaw shorter than the upper, lips hard and smooth, thirty-nine scales along the lateral line, and thirteen in an oblique row from the base of the ventrals to the dorsum, lower lobe of the caudal longer than the upper. D.12 : P.17 : V.9 : A.7 : C. $\frac{9}{10}$.

HAB. Upper Assam. Griff. Coll.

Variet. Cyp. bata, Buch. P. G. p. 383.

Upper lobe of the caudal longer than the lower, with an ill defined transverse bar, ventrals smaller than the pectorals. D.12 : P.17 : V.9 : A.8 : C.19.

HAB. Rivers and ponds in Bengal, where it attains a foot in length.

* From *anisos* unequal, and *oura* a tail.

Spec. G. limnophilus,* J. M. t. 55. f. 3.

Scales in parallel rows, thirty-six in each row, and twelve across the body. D.10 : P.19 : V.9 : A.7 : C.19.

HAB. Ponds in Bengal. Length $12\frac{1}{2}$ inches.

In the remaining species the scales are as usual in oblique rows.

Spec. Cyp. pangusia, Buch. t. 42. f. 1. β †

Snout fleshy, porous, and prominent, forty-one scales along the lateral line, and fifteen across the body; lips fimbriated. D.14 : P.18 : V.9 : A.7 : C.19.

HAB. Bengal, where it attains a span in length.

Spec. Cyp. arisa, Buch. Jour. Mys. 111. t. 31.

Snout and under lip smooth, twelve rays in the dorsal; in other respects it resembles the last.

Spec. G. ricnorhynchus, J. M. t. 55. f. 1.

Snout thick and wrinkled, forty-three scales along the lateral line, and ten across the body from the base of the ventrals to the dorsum. D. 12 : P. 17 : V. 9 : A. 7 : C. 19.

HAB. Northern parts of Bengal, here it was found by Mr. Hodgson.

* From *Λυμνη* a swamp or lake, and *φίλος* to love or frequent.

† Its form is not so slender as represented in the figure. Buchanan also gives seventeen rays to each pectoral, and eight to the anal.

Spec. G. malacostomus.* J. M.

C. falcata. Gray Hardw. Illust. t.—?†

Nepura of the Assamese.

Snout thick, fleshy, and perforated with numerous large mucous pores, margins of the lips double and fimbriated.

D. 12: P. 16: V. 9: A. 8: C. 19.

HAB. Rapids in Upper Assam. Length from six to twelve inches. Mr. Griffith's Coll.

V. GEN.—GONORHYNCHUS.

CHAR. Mouth situated under the head, which is long and covered with thick integuments, body long and sub-cylindrical, snout perforated by numerous mucous pores, dorsal and anal short, opposite, and without spines. The intestine and stomach form a continuous tube about eight lengths of the body.

OBS. This genus hitherto rested on a single species long since found at the Cape of Good Hope, but the *Garra* of Buchanan chiefly belong to it, as well as several species which have since been found in India.

The first three species are without cirri.

Spec. G. gobioides, J. M. t. 43. f. 1.

Herilwa of the Assamese.

Altitude of the body to its length as one to four, thirty-seven scales along the lateral line, and nine in an oblique row

* From *μαλακος* soft, and *στομος* the mouth.

† This plate is not numbered in Hardwicke's Illustrations, nor is it included in the list of plates prefixed to the volume.

from the base of the ventrals to the dorsum. D.10 : P.15 : V.9 : A.7 : C.19.

HAB. Bramaputra, in Assam. Length about a span.

Spec. G. petrophilus, J. M. Jour. Asiat. Soc. iv. t. 1.

Scales very minute, body and head long, eight rays in the dorsal.*

Spec. G. rupiculus, J. M. t. 43. f. 4. 5.

Snout thick and smooth, pectorals rounded;† fins short, and the membrane in which their rays are enclosed thick and opaque; thirty-five scales along the lateral line, and nine in an oblique row across the body. D.8 : P.10 : V.9 : A.6 : C.20.

HAB. Mishmee mountains. Length about two inches. Griffith's Coll.

Spec. G. bimaculatus, J. M.

Snout warty, porous, and divided by a fissure, without cirri; a black spot at the base of the caudal, lower lobe of the caudal longer than the upper, thirty-four scales along the lateral line and eight rows between the ventrals and dorsum; pectorals and ventrals lanceolate. D.9 : P.13 : V.9 : A.7 : C. $\frac{9}{10}$.

HAB. River Laeoh at the foot of the Mishmee mountains, where it was found by Mr. Griffith.‡

* The habits of this species are fully described, but we want to know more of its specific characters.

† The form of the pectorals is not accurately represented in the figure.

‡ Also at the foot of the Nipal mountains, where Mr. Hodgson appears to have found a specimen now in the Asiatic Society's collection. In this, however, the lobes of the caudal are of equal length. It is so like the succeeding variety that I have thought it unnecessary to figure it separately.

Spec. Cyp. lamta, Buch. t. 43. f. 2. β P. G. p. 343.

Cyp. godiyava, id. Coll.

Four very short cirri, pectorals and ventrals lanceolate, and a black spot on either side of the tail, snout thick and warty.
D.10 : P.13 : V.9 : A.7 : C.19.

HAB. Northern parts of Bengal, where it attains $2\frac{1}{2}$ or three inches in length.

Spec. G. gotyla, Gray, Hardw. Illust. t. 88. f. 3.

Snout thick, and divided by a deep transverse fissure in which numerous large mucous pores are situated, a fleshy pendulous point at each corner of the mouth ; four minute cirri.

HAB. Mountains of India.

Spec. G. fimbriatus, t. 43 f. 3. β

Cyp. sada, Buch. P. G.

Four cirri little shorter than the head, pectorals and ventrals falcate. D.10 : P.— ? V.9 : A.7.

HAB. Northern parts of Bengal, where it attains a few inches in length.

The remaining three have each two small cirri.

Spec. G. macrosomus,* t. 43. f. 7. β

Cyp. latius, Buch. P. G. p. 346.

Depth of the body to the entire length as one to six, two cirri, scales small. D.11 : P.13 : V.9 : A. 7 : C.20.

HAB. Northern parts of Bengal.

* From *Μακρος* long, *σωμα* the body.

Spec. Cyp. gohama, Buch. P. G. p. 346. t. 43. f. 6.β

Cyp. dyangra, id. Coll.

Is shorter in proportion, and more arched above and below than the former, and has eight rays in the anal.

HAB. Northern parts of Bengal.

Spec. G. brachypterus, J. M.

Lower surface of the head flat with a cartilaginous zone behind the mouth like *G. rupiculus*,* a few irregular pores on the snout, thirty-six scales on the lateral line and seven rows across the body.

HAB. Mishmee mountains. Griff. Coll.

II. SUB-FAM.—SARCOBORINÆ,† J. M.

CHAR. Mouth directed upwards, or more widely cleft and horizontal, with a bony prominence more or less distinct, serving as a prensile tooth on the symphysis of the lower jaw; colours bright, disposed in spots and streaks, or evincing an uniform lustre. The stomach is a lengthened sack ending in a short abdominal canal. Three rays in the branchial membrane.

OBS. Like the *Pæonominæ*, they occur only in fresh water, and although they are generally small, yet from the vast numbers in which they abound in every pond they must be considered as of considerable importance.

* It also agrees with that species in the form of its fins; the presence of two very minute cirri being my chief reason for separating them, I have not thought it necessary to give a figure.

† From *Σαρκοβορος*, carnivorous.

I. GEN.—SYSTOMUS.* J. M.

CHAR. Intermaxillaries protractile, dorsal and anal short, the former opposite to the ventrals and preceded by a spinous ray; body elevated, and marked by two or more distinct dark spots, or diffuse spots either on the fins or opercula, prominence on the apex of the lower jaw obscure.

OBS. In the following species the depth of the body is equal to about half the length, and the spinous ray of the dorsal is serrated behind, except when otherwise described.

Spec. S. immaculatus, J. M. t. 44. f. 5.

Four cirri, a slight golden tinge on the opercula, fins dark, thirty-two scales on the lateral line and ten in an oblique line from the base of the ventrals to the dorsum. D.11 : P.15 : V. 9 : A.7 : C.19.

HAB. Small streams with sandy bottoms in Assam, and probably occasionally in the large rivers.

Spec. S. chrysosomus, J. M.

Two minute cirri, thirty-five scales along the lateral line; opercula and suborbital plates stained with gold yellow. D. 10: P.16 : V.8 : A.8 : C.19.

HAB. Bengal. Length about six inches.†

* From *Systomos*, that has a narrow mouth.

† From a figure in Capt. Burnes' Collection, this species would also seem to be an inhabitant of the Indus; it is nearly allied to the preceding species, and is probably a variety only.

Spec. S. tetrapagus, J. M. t. 44. f. 3.

Cyp. titius, Buch. (?) P. G. 315.

No cirri, a black spot on either side behind the opercula and another at the end of the tail. D.10 : P.12 : V.9 : A.7 : C.20.

HAB. Bramaputra and ponds in Assam.*

Spec. S. chrysopterus, J. M.

No cirri or spots, pectorals and ventrals red, twenty-three scales along the lateral line and eight in an oblique line from the base of the ventrals to the dorsum. D.9 : P.13 : V.9 : A.7 : C.18.

HAB. Bengal and Assam, and is numerically of great importance, though its size is small.†

Spec. S. pyropterus, J. M. t. 44. f. 1.

No cirri, fins red, a black spot over the situation of the anal, twenty-four scales along the lateral line, and nine in an oblique row from the base of the ventrals to the dorsum. D.9 : P.12 : V.9 : A.7 : C.19.

HAB. Very numerous in ponds in Upper Assam.

Spec. C. sophore, Buch. P. G. t. 19. f. 86.

Without cirri, spinous ray of the dorsal smooth behind, a black spot on the tail and another on the dorsal, opercula yellow. D.10 : P.14 : V.9 : A.7 : C.19.

HAB. Bengal.

* *Cyprinus ticto*, Buch. P. G. t. 8. f. 87, is nearly allied to this species, but shorter.

† As I suspect this to be a variety of *S. pyropterus* I have not thought it unnecessary to add a figure.

Spec. Cyp. chola, Buch. t. 58 f. 3. β

Two cirri, a yellow spot on the opercula, and a black spot on the middle of the tail; the spinous ray of the dorsal smooth behind. D.10 : P.13 : V.9 : A.7 : C.19.

HAB. Northern parts of Bengal.

Spec. S. gibbosus, t. 44. f. 7. β

Cyp. terio, Buch. P. G. 313. *Cyp. teripungti*, id. Coll.

Back abruptly arched, below straight, no cirri, dorsal spine smooth behind, with a black spot near the middle of the side. D.11 : P.13 : V.9 : A.8 : C.19.

HAB. Northern parts of Bengal.

All the remaining species but the last two are furnished with a dorsal spine serrated behind; none of them have cirri.

Spec. Cyp. conchoni, Buch. t. 44. f. 8. β

A black spot on the lateral line over the insertion of the anal, fins pale, dorsal spine serrated behind; the fin rays are D.10 : P.10 : V.9 : A.8 : C.19.

HAB. Northern parts of Bengal.

Spec. Cyp. gelius, Buch. t. 44. f. 4. β

An irregular black spot or streak at the base of all the fins but the pectorals; abdomen silvery, bounded behind with a dark streak, twenty-five scales on the lateral line, and eight in an oblique row from the base of the ventrals to the dorsum. D.10 : P.13 : V.9 : A.7 : C.19.

HAB. Bengal; and scarcely attains two inches in length.*

* It is not improbable that as Buchanan gives eight rays to the ventrals, he may have described the following variety for the one figured.

A variety of this last species with twenty-three scales along the lateral line, and ten in an oblique row from the base of the ventrals to the dorsum, is common in swamps about the neighbourhood of Calcutta.

Spec. S. leptosomus,* t. 44. f. 2. β

Cyp. phutunio, Buch. P. G. 319.

Cyp. phutunipungto, id. Coll.

Twenty scales along the lateral line and seven across the body, a black streak over the pectorals on either side, and another over the anal, with an obscure streak in front of, and another behind the dorsal. D.10 : P.12 : V.8 : A.7 : C.19.

HAB. Bengal, where it attains about $1\frac{1}{2}$ inches in length.

Spec. Cyp. canius, Buch. t. 44. f. 6. β P. G. p. 320.

Cyp. ranipungti, id. Coll.

Red. Abdomen silvery and diaphinous, base of the fins and body marked with dark spots. D.10 : P.8 : V.9 : A.7.

HAB. Bengal. Length about $1\frac{1}{2}$ inches.

Spec. S. malacopterus, t. 44. f. 9. β

Cyp. cosuatis, Buch. P. G. 338.

Cyp. coswati, id. C. D.

Back abruptly arched, no spine in the dorsal, which with the ventrals is marked with an irregular black stain. Twenty-three scales along the lateral line, and either five or six rows from the base of the ventrals to the dorsum. D.10 : P.15 : V.9 : A.7 : C. $\frac{10}{9}$

HAB. Bengal, and is seldom above two inches in length.

* From *leptos* small, and *σωμα* the body.

II. GEN.—ABRAMIS.

CHAR. Body short and elevated, a short dorsal is placed opposite to the ventrals, colours plain, anal long.

OBS. One species only has hitherto been discovered in India.

Spec. *Cyp. cotis*, Buch. P. G. Pl. 59. f. 93.

Body silvery white, scales very small, a small black spot is situated at the base of the dorsal. The fin rays are D.10 : P.13 : V.10 : A.32 : C.19.*

III. GEN.—PERILAMPUS,† J. M.

CHAR. Head small, obliquely raised above the axis of the body ; dorsal placed opposite to a larger anal ; apices of the jaws raised to a line with the dorsum, which is straight ; the ventral margin is much arched ; sides usually streaked with blue ; fins without spinous rays.

OBS. In this genus the intestine is small, and very little longer than the body. The species all subsist exclusively on insects, which they seize by leaping above the surface. They vary from two to four inches in length.

In the first two species, the altitude of the body is equal to half its length.

Spec. *Cyp. devario*, Buch. P. G. t. 6. f. 94.

Back arched, sides marked with a single interrupted blue streak. D.18 : P.10 : V.8 : A.18 : C.19.

HAB. Bengal and Assam.

* Buchanan makes the fin rays D.10 : P.16 : V.12 : A.36 : C.19. the discrepancy depends on the difficulty of counting the rays in some of the fins of this small species.

† From *Περιλαμπω* to irradiate, or shine brilliantly.

Spec. P. ostreographus,* J. M. t. 45. f. 3.

Back straight, sides marked with several blue streaks. D.12 :

P.15 : V.8 : A.16 : C.19.

HAB. Assam.

In the next two species the altitude of the body is equal to a third of the length.

Spec. P. perseus,† J. M. t. 46. f. 5.

Pectorals and ventrals long, one blue streak on either side.

D.19 : P.8 : V.5 (?) A.21 : C.—

HAB. Assam, and probably Bengal.

Spec. P. guttatus, t. 45. f. 4. β

Cyp. laubuca, Buch P. G. p. 260.

A small green or blue spot over the base of each pectoral, and another at the base of the caudal, on either side. D.10 :

P.12 : V.7 : A.24 : C.—

HAB. Northern parts of Bengal.

In the following two, the first ray of each ventral is prolonged to half the length of the body.

Spec. P. psilopteromus,‡ t. 46. f. 4. β

Cyp. loyukula, Buch. Coll.

Cyp. atpar, id. P. G. p. 259.

Depth of body almost equal to half its length, much compressed, ventrals elongated, a narrow blue streak along the lateral line, D. 9 : P. 11, or 12 : V. 5 : A. 25 : C.—

HAB. Bengal.

* Οστρειογραφης, marked with purple streaks ; from οστρειον γραφω.

† *Perseos*, the Greek name of an unknown fish.

‡ From *Psilos* slender, *pteroma* the fin of a fish.

*Spec. Cyp. cachi*us, Buch. t. 46. f. 6. β

Cyp. kachki, id. Coll.

Diaphinous, ventrals elongated. D.7 : P.8 : V.3 : A.26.

HAB. Sunderbuns, and southern parts of Bengal.*

The following species have four cirri. In the two first the depth is equal to about a fourth of the entire length of the body.

Spec. P. reticulatus, t. 45. f. 1. β

Cyp. dangila, Buch. P. G. p. 321.

Reticulated purple stripes on the sides, caudal almost entire.

D.13 : P.12 : V.7 : A.17 : C.20.

HAB. Rocky streams in Behar.

Spec. P. striatus, t. 46. f. 1. β

Cyp. rerio, Buch. P. G. p. 322.

Dorsal round, four or five bright blue stripes on the sides.

D.8 : P.10 : V.7 : A.17 : C.18.

HAB. Bengal, particularly the Sunderbuns.

In the following three, the depth is equal to about a fifth of the entire length. They have each four cirri, and the anal is short.

Spec. P. recurvirostris, t. 46. f. 2. β

Cyp. jogia, Buch. P. G. p. 326.

A dark blue stripe extended from the eyes to the caudal, apices of the jaws recurved. D.9 : P.12 : V.8 : A.7 : C.19.

HAB. Bengal, from Calcutta to Purnea.

* This is the smallest species of the group, being only about an inch in length.

Spec. P. macropterus, t. 46. f. 3. β

Cyp. sutiha, Buch. P. G. p. 327.

Much compressed, diaphinous below the lateral line, caudal large, first ray of the other fins extended to a lengthened filament. D.8 : P.10 : V.7 : A.7 : C.19.

HAB. Gurruckpore district.

Spec. P. thermophilus, J. M.* t. 54. f. 19.

Head very obliquely raised, green above, below silvery, thirty-one scales on the lateral line and seven rows across the body. D.8 : P.9 : V.8 : A.7 : C.20.

HAB. Found by Dr. Cumberland in Hot Springs at Pooree. Temperature of the Springs 110° Far.

IV. GEN.—LEUCISCUS.

CHAR. Dorsal and anal small, without spinous rays, head horizontal, mouth of moderate size, scales and opercula covered with a copious silvery pigment.

OBS. The stomach is capacious as well as the intestine, which is short, seldom exceeding the length of the body. The anal is generally smaller than the dorsal, and the mouth directed slightly upward. Seldom with cirri.

* I have here reserved the initials J. M. for species that have not before been described, or which I have been unable to refer to Buchanan's descriptions; but I am responsible for all new specific names in this paper, whether such initials be attached to them or not. I may observe, however, that I have been more anxious to identify Buchanan's species than to describe new ones, and to reserve his names than to substitute others.

Spec. Cyp. daniconius, Buch. P. G. t. 15. f. 89.

A dark stripe extends over each side of the head along the lateral line to the caudal; lower jaw pointed, and received into a notch in the upper. D.9 : P.13 : V.9 : A.7 : C. 19.

HAB. Bengal, where it only attains about two inches in length.

Spec. L. lateralis, P. G. 328.

Cyp. anjana, Buch.

Two streaks on each side, jaws somewhat depressed, the lower jaw longer than the upper, pointed and received into a notch. D.9 : P.13 : V.9 : A.7 : C.19.

HAB. Northern parts of Bengal.

Spec. L. dystomus,* J. M. t. 56. f. 4.

Cyp. elanga, Buch. (?) P. G. 281.

Two small cirri, forty scales along the lateral line, eleven oblique rows between the base of the ventrals and the dorsum. D.9 : P.15 : V.9 : A.7 : C. 19.

HAB. Bramaputra in Assam.

Spec. Cyp. rasobora, Buch. P. G. t. 2. f. 90.

Three prehensile knobs on the lower jaw, caudal tipt with black, twenty-five scales along the lateral line and seven across the body. D.9 : P.13 : V.9 : A.8 : C. $\frac{10}{9}$.

HAB. Bengal and Assam.

* Δυστομος hard-mouthed.

Spec. Cyp. mola, Buch. P. G. t. 38. f. 92.

A lead-coloured streak along the lateral line, scales small and easily detached, depth equal to a third of the length.

D.9 : P.15 : V.9 : A.7 : C.19.

HAB. Ganges and Bramaputra.

Spec. L. pellucidus, J. M.

A lead-coloured streak along the lateral line, depth equal to a fourth of the entire length. D.8 : P.16 : V.9 : A.6 : C.19.

HAB. Ganges and Bramaputra.

In others the anal contains as many and even more rays than the dorsal, but they are short ; in these the mouth is horizontal.

Spec. Cyp. apíatus, Jaquem. Voy dans l'Inde. t. 15. f. 3.

Spec. L. branchiatus, J. M. t. 42. f. 5.

Scapulary and branchial plates present a broad silvery surface behind the opercula, forty-four scales along the lateral line, and ten in an oblique row from the base of the ventrals to the dorsum. D.8 : P.14 : V.9 : A.10 : C.18.

HAB. Assam and the northern parts of Bengal.*

Spec. Cyp. chedra, Buch. Hardw. Illust. t. 87. f. 3.

Scapulary plates exposed, caudal extremity of the body recurved. The fin rays are, D.10 : P.14 : V.9 : A.11 : C.18.

HAB. Northern parts of Bengal.

* A variety of this species has a row of black dots crossing the rays of the dorsal, which with each ventral has nine rays.

Spec. L. margarodes,* J. M.

Snout rather prominent, first suborbital plate extends to the mouth, scales small, lower lobe of the caudal rather longer than the upper. D.9 : P.15 : V.8 : A.8 : C.19.

HAB. Upper Assam, where it was found by Capt. Hannay.

Spec. Cyp. morar, Buch. P. G. t. 31. f. 75. *Chula* of the Assamese.

Suborbital plates extend to the corner of the mouth, scales large, loosely attached, and covered with a copious white pigment. D.10 : P.14 : V.8 : A.12 : C.19.

HAB. Bramaputra.

Spec. Cyp. cocea, Buch. P. G. t. 3. f. 77.

Four cirri, suborbital plates extend to the mouth, several incomplete bars descend partially across the sides, forty-two scales along the lateral line, and eleven in an oblique row from the base of the ventrals to the dorsum. D.9 : P.13 : V.9 : A.10 : C.19.

HAB. Northern rivers of Bengal, where it attains a span in length.

Spec. L. elingulatus, J. M. t. 57. f. 4.

Peril. elingulatus, id. J. A. S. vol. vii. t. 56. f. 4.

No cirri, head high and compressed, snout blunt, forty-six scales on the lateral line, and eleven in an oblique row from the base of the ventrals to the dorsum. D.9 : P.13 : V.9 : A.10 : C.19.

HAB. Mountain streams at Simla. Dr. Macleod's Coll.

* *Μαργαρωδης*, resembling pearl. The scales of this species would afford abundant materials for the manufacture of mock pearl. There is a variety of this species with nine rays in the ventral, and eight in the anal fin.

V. GEN.—OPSARIUS,* J. M.

CHAR. Mouth widely cleft, body slender, and usually marked with transverse green streaks or spots, dorsal small without spines, and placed behind the middle, anal long, lower margin of the body more arched than the upper.

OBS. Intestine very short, and extends almost straight from the stomach to the vent.

The first three are silvery white, without bars or spots, and have the dorsal opposite to the commencement of the anal and the lower lobe of the caudal longer than the upper.

Spec. O. pholicephalus, J. M. t. 47. f. 2.

Cyp. gora, Buch. P. G. p. 263.

Pectorals long, ventrals small, scales extended on the crown over the situation of the eyes, dental hook very prominent. D.9 : P.13 : V.8 : A.17.

HAB. Assam and Bengal.

Cyp. bacalia, Buch. P. G. t. 8. f. 76.

Depth equal to a third of the length of the body, two lateral lines on each side. D.9 : P.12 : V.9 : A.16 : C.19.

HAB. All parts of India.

Spec. O. leucerus, J. M. t. 47. f. 3.

Depth equal to a fourth of the length. Ventrals very small. D.9 : P.13 : V.9 : A.14 : C.18.

HAB. Bengal and Assam.

* From *οψαριον*, *pisciculus*, a small fish.

Spec. O. albulus, J. M. t. 48. f. 10. β

Cyp. phulo, Buch. P. G. p. 262.

Nape extends to the eyes, head short, lower lobe of the caudal somewhat longer than the upper. D.9 : P.11 : V.8 : A.20 : C.18.

HAB. North-western parts of Bengal.

The following two have a portion of the dorsal in front of the anal, and the depth equal to about a third of the length.

Spec. O. cirratus, t. 56. f. 5. β

Cyp. shakra, Buch. P. G. p. 271.

Four cirri, branchial plates exposed behind the opercula, lower lobe of the caudal longer than the upper. D.9 : P.13 : V.9 : A.10 : C.20.

HAB. Kosi river.

Spec. O. fasciatus, t. 48. f. 9. β

Cyp. borna, Buch. P. G. p. 268.

A longitudinal yellow streak, and about nine incomplete green cross bars on each side. D.9 : P.13 : V.9 : A.12 : C.19.

HAB. Ganges, Bramaputra, and Jumna.

In the following three, the depth is equal to about a fourth of the length ; the dorsal is placed opposite to the interval between the ventrals and anal ; the branchial plates exposed and broad.

Spec. O. maculosus, t. 47. f. 4.

Cyp. tileo, Buch. P. G. p. 276.

Apex of the lower jaw without a tooth but sharp, and received into a notch in the upper jaw ; two rows of oblong transverse spots, D.9 : P.14 : V.8 : A.15 : C. $\frac{8}{10}$.

HAB. Ganges and Bramaputra.

Spec. O. brachialis, J. M. t. 48. f. 6.

Head short, pectorals removed backwards by the breadth of the branchial plates, sides marked with two rows of oblong transverse spots. D.9 : P.14 : V.9 : A.13 : C. $\frac{10}{9}$.

HAB. Assam.*

Spec. Cyp. bendelisis, Buch. Jour. Mys. 111 t. 32.

Ten incomplete bars on each side, two cirri, nine rays in the dorsal and eleven in the anal. D.9 : P.13 : V.9 : A.11 : C.19.

HAB. Assam and other parts of India.

In all the remaining species the body is long, the depth being equal to one-fifth of the length.

Spec. O. gracilis, t. 47. f. 1.

Cyp. goha, Buch. Hardw. Illust. t. 5. f. 3.

Head long, mouth cleft beyond the eyes, dorsal opposite to the space between the ventrals and anal, sides spotted. D.10 : P.13 : V.9 : A.12 : C.18.

HAB. Ganges and Bramaputra.

* I am not sure as to the accuracy of separating this from the last.

Spec. O. megastomus, t. 48. f. 5. β

Cyp. bola, Buch. P. G. p. 274.

Head small, mouth cleft beyond the eyes, several transverse green bands on the sides. D.10 : P.16 : V.9 : A.11 : C.19.

HAB. Bramaputra.

Spec. O. isocheilus, t. 56. f. 1. β

Cyp. vagra, Buch. P. G. p. 269.

Jaws of equal length, sides silvery, marked with ten minute transverse spots. D.9 : P.13 : V.9 : A.14 : C.16.

HAB. Ganges.

Spec. O. anisocheilus, t. 48. f. 8. β

Cyp. barila, Buch. P. G. p. 267.

Cyp. chedrio, id. l. c.

Upper jaw more prominent than the lower, mouth rather small, incomplete bars on the sides. D.8 : P.14 : V.8 : A.13.

Spec. O. latipinnatus, J. M. t. 48. f. 7.

Balisunderi of the Assamese.

Sides marked with transverse green bars, dorsal opposite to the ventrals, and contains nine rays widely separated from each other, the first preceded by a short isolated ray.*

HAB. Upper Assam.

* Further information is required regarding this species ; having lost the only specimen I had I am unable to add its specific characters more fully.

SUB-FAM.—APALOPTERINÆ,* J. M.

Consists of those genera, the species of which have either elongated cylindric bodies or flat heads, as the Loaches and *Peciliæ*. They are without spinous rays in any of the fins, the intestine is short, and enveloped in a copious mucous secretion; three to six rays in the branchial membrane.

I. GEN.—PLATYCARA,† J. M.

CHAR. Head flat, with the eyes placed on the upper surface, fins thick and opaque, pectorals large, anal small, caudal bifid, mouth without teeth and placed on the lower surface of the head, three rays in the branchial membrane.

OBS. The stomach and intestine form a continuous fleshy tube, not much exceeding the length of the body; they are found in elevated mountain streams.

Spec. P. maculata, t. 49. f. 1.

Balitora maculata, Gray. Hardw. Illust. t. 88. f. 2.

Obscure irregular spots on the body, and two rows of the same on the caudal. D.8 : P.17 : V.9 : A.6 : C.19.

HAB. Boutan mountains. Griff. Coll.

Spec. Balitora Brucei, Gray, t. 49. f. 1. Hardw. Illust. t. 88. f. 2.

Fins barred with dark streaks, body spotted.‡

* Etym. Απαλος soft, and πτερον a fin or wing.

† For etymology, see page 246.

‡ This species, I believe, at present depends chiefly on a figure in the work referred to.

Spec. P. nasuta, J. M. t. 57. f. 2. J. A. S. vol. vii. t. 55. f. 2.

A deep depression on the snout between the eyes, thirty-four scales on the lateral line, and eight in an oblique row from the base of the ventrals to the dorsum. D.10 : P.16 : V.9 : A.6 : C.15.

HAB. Kasyah mountains. Griff. Coll.

II. GEN.—PSILORHYNCHUS,* J. M.

CHAR. Muzzle elongated and flattened, eyes placed on the edges of the head, mouth small and suckorial without cirri, opercula small, caudal bifid, dorsal opposite to the ventrals.

Spec. P. sucatio t. 50. f. 1. β

Cyp. sucatio, Buch. P. G. p. 347.

Eyes placed far back near the branchial aperture. D.9 : P.13 : V.9 : A.7 : C.19.

HAB. North-eastern parts of Bengal.

Spec. P. variegatus, 50. f. 2. β

Cyp. balitora, Buch. P. G. p. 348.

Diaphinous, silvery below, above spotted, one row of cloud-like spots on the back, and another on each side. D.10 : P.12 : V.9 : A.7 : C.18.

HAB. North-eastern parts of Bengal.

III. GEN.—PÆCILIA, J. M.

CHAR. Head flat, minute teeth inserted along the edges of the jaws, caudal entire ; from four to six rays in the branchial membrane.

* For etymology, see page 248.

OBS. This genus includes the *Pæcilia propria*, Schn. *Lebias*, Cuv. *Fundulus* Lacep. *Molinesia*, Leseur. *Cyprinodon*, Lacep. They are here reduced to sub-genera; and the following Indian sub-genus is added to the group*.

SUB-GEN.—APLOCHEILUS,† J. M.

CHAR. Intermaxillaries fixed, apices of the jaws broad, flat, and directed upwards; five rays in the branchial membrane; fins transparent.

OBS. A short dorsal is placed opposite to the last ray of a long anal, the ventrals are very small; the intestine and stomach form together a small tube scarcely longer than the body.

Spec. A. chrysostigmus,‡ J. M. t. 42. f. 2.

A bright gold-like spot on the occiput, another in front of the dorsal; about twenty-eight scales on the lateral line, and nine rows between the ventrals and dorsum; a single uniform row of straight teeth. D.7 : P.13 : V.— : A.17 : C.18.

HAB. Sunderbuns and ponds about Calcutta. Scarcely an inch in length.

Spec. A. melastigmus,§ J. M. t. 42. f. 3.

A black spot at the base of the dorsal, ventrals very minute, teeth slightly hooked and crowded at the sides of the mouth. D.7 : P.10 : V.—? A.22 : C.18.

HAB. Tanks in Calcutta, and being scarcely an inch in length, is the smallest Indian species of the family.

* In the Regne Animal, we have in this part of the family almost as many genera as species, while the whole of the important groups composing the *Pænomiæ* and *Sarcoborinæ* are described as sub-genera.

† *Ἀπλος* simple or single and *Χείλος* the lip.

‡ Etym. *chrysos* gold, and *stigma* a mark.

§ From *melas* black, and *stigma* a spot.

Spec. Esox panchax, Buch. P. G. t. 3. f. 69.

A black spot on the dorsal, opercula covered with scales.

D.6 : P.16 : V.6 : A.14 : C.16.

HAB. Sunderbuns in Bengal, where it attains two inches in length.

There is still a fourth species, t. 55. f. 4. which I derive from Buchanan's collection of drawings, but cannot find it referred to in the Gangetic Fishes, we must therefore postpone naming it until we see the papers of the late Doctor, or the species itself.

IV. GEN.—COBITIS. LIN.

CHAR. Head and body elongated, little compressed, and no where depressed; the dorsal and ventral margins are little arched, and in some, almost straight; the snout is long and directed obliquely downwards, and projects slightly in front of a soft mouth, which is surrounded with short muscular cirri; three rays in the branchial membrane.

OBS. I sub-divide them into two sub-genera according to their general structure and the form of the caudal fin.*

* Since the remarks were made in a preceding part of this paper on Mr. Gray's sub-division of the Loaches, I have been favoured with the perusal of a part of M. Agassiz's great work on Fossil Fishes, in which I perceive the spined Loaches are separated from the Linnæan genus as proposed by Mr. Gray. Surely a principle of division must be unnatural that would separate such species as *Cob. oculata*, t. 51. f. 1. and *Cob. pavonacea*, t. 52. f. 1.; and bring together such species as *Cob. dario*, Buch. P. G. t. 29. f. 95. and *Cob. cinnamomea*, t. 51. f. 5.—? : yet such would be the effect of adopting Mr. Gray's genus *Botia*, or what would be the same thing, M. Agassiz's genus *Acanthopsis* which differ only in name.

a SUB-GEN.—COBITIS PROPRIA.

CHAR. Caudal entire, large, and ornamented as well as the dorsal with bars or spots; prevailing colour of the body various shades of brown, disposed in more or less dense nebulæ.

OBS. Air vessel small, oval, bony, and placed over the pharynx. The stomach is small and a little curved so as to bring its lower orifice in front of the organ when empty; in this state the intestine extends straight to the vent, but when the stomach is distended the intestine forms a few short serpentine turns. The first five apices have double suborbital spines on either side, except otherwise stated.

Spec. C. oculata, t. 51. f. 1. β

C. gongota, Buch. P. G. 351.

Orbits raised above the frontals, pupils small and vertical, pectorals and ventrals round, branchial membrane, large and attached behind to the base of the pectorals. D.11 : P.10 : V.7 : A.7 : C.16.

HAB. Assam, and the northern parts of Bengal.

Spec. C. cucura, Buch. t. 51. f. 2. β

Clouded with black along the lateral line, all the fins but the anal rounded. D. 9 : P.9 : V.6 : A.7 : C.15.

HAB. Northern parts of Bengal.

Spec. C. guntea, Buch. t. 51. f. 3. β

Two nebulous stripes on the sides, the lateral line copper colour. D.8 : P.8 : V.7 : A.7 : C.17.

HAB. Bengal and Assam.

Spec. C. bimucronata, t. 51. f. 4. β

C. botia, Buch.

A single spine under each eye, body greenish above, below silvery, with a red tinge on the fins. D.14: P.13: V.8: A. 8: C.15.

HAB. North-eastern parts of Bengal.

Spec. C. cinnamomea, t. 51. f. 5. β

C. pangia, Buch.

Very long and low, of cinnamon colour; dorsal opposite to the interval between the ventrals and anal. D.7: P.10: V.6: A.7: C.18.

HAB. North-eastern parts of Bengal.

The remaining species are without suborbital spines, and the dorsal is placed over the ventrals. They have each six cirri, and bars on the caudal and dorsal, which last is placed over the ventrals.

Spec. C. ocellata, t. 51. f. 6. β

C. bilturia, Buch. P. G. Coll.

A small eye-like spot at the upper base of the caudal, and another at the hinder base of the dorsal; silvery, with clouded streaks. D.14: P.14: V.8: A.7: C.19.

HAB. Bramaputra.

Spec. C. gibbosa, t. 52. f. 7. β

C. turio, Buch. P. G. Coll.

Back abruptly arched, a small ocellated spot on either side at the base of a square caudal. D.8: P.12: V.8: A.7: C.19.

HAB. Bramaputra.

Spec. C. pavonacea, J. M. t. 52. f. 1.

Body long, crossed by about twenty half bars, with an ocellated spot at the base of the caudal on either side. D.17: P.13: V.9: A.6: C.20.

HAB. Assam.

Spec. C. monocera, J. M. t. 52. f. 2.

Body without clouded or other marks, but the caudal and dorsal are ornamented with cross bars; a short blunt spine on the snout. D.12: P.12: V.8: A.6: C.18.

HAB. Assam.

Spec. C. chlorosoma, J. M. t. 52. f. 3.

Light green, clouded with a darker green, caudal and dorsal marked with spots in transverse rows. D.11: P.12: V.8: A.6: C.18.

HAB. Upper Assam.

The two remaining species have each only four cirri.

Spec. C. guttata, J. M. t. 52. f. 5. 6.

Colour light green, with dark blotches, eight rays in the dorsal.

HAB. Upper Assam.

Spec. C. phoxocheila,* J. M. t. 52. f. 4.

Brown, caudal alone with bars, head much compressed, and raised obliquely as in the Perilamps. D.8: P.8: V.6: A.6: C.16.

HAB. Mishmee mountains. Griff. Coll.

* Φοξοχειλος, that has pointed lips.

b. SUB-GEN.—SCHISTURA,* J. M.

CHAR. Caudal bilobate, dorsal and ventrals opposite, anal short ; with or without suborbital spines ; sides ornamented with fasciated bars, mostly green.

OBS. The intestine is somewhat longer than that of the true Loaches (*Cobitis propria*), being usually reflected once upon the stomach.

The following species have each six cirri, and two suborbital spines on either side, except when stated to the contrary. The three first have a membranous natatory bladder placed in the abdomen, as in *Pæonominæ*, but its cells are separated by a longitudinal septum instead of a transverse stricture. Their form is arched and high as in ordinary Cyprins.

Spec. C. dario, Buch. P. G. t. 29. f. 95.

Seven transverse bars bifurcating and becoming faint below ; three or four interrupted bars on the caudal. D.11 : P.13 : V.8 : A.8 : C. $\frac{9}{10}$.

HAB. Ganges and Bramaputra.

Spec. C. geta, Buch. P. G. t. 11. f. 96.

Seven transverse bars on the sides, one crossing the eyes, and one or two interrupted bars on the caudal.† D.12 : P.13 : V.8 : A.8 : C.19.

HAB. Bengal and Assam.

* Etym. Σχίστρος split or separated, and οὐρα cauda.

† I observed a slight difference in the form and number of the bars in some varieties of this species.

Spec. Botia grandis, Gray, Hardw. Illust. t. 94. f. 3.

Body olive-brown, with irregular yellow spots and streaks; eight cirri?

HAB. Said to have been found in the mountains of Kumaon; its description I believe is yet a desideratum; and as the only spotted species known, it might be named *S. maculata*.

The fins of the remaining species are without bars, spots, or other ornaments; the air vessel is bilobate, and placed over the pharynx, and the body is long and cylindric as in the true Loaches.

Spec. C. balgara, Buch. t. 53. f. 2. β

Clouded with brown above, below silvery. D.7 : P.7 : V.7 : C.17.

HAB. Northern frontier of Bengal.

Spec. S. aculeata, J. M.*

Trenchant bony ridge between the eyes, clouded streaks on the sides. D.8 : P.9 : A.7 : C.—?

HAB. Assam.

Spec. S. montana, J. M. t. 57. f. 1. J. A. S. vol. vii. t. 55. f. 1.

Twelve zones encircling the body, with a black bar at the insertion of the caudal, and a single suborbital spine on each side. D.8 : P.10 : V.8 : A.6 : C.18.

HAB. Mountains at Simla. Dr. Macleod's Coll.

* This species corresponds in form with the preceding so closely that I have not figured it, and as I have not found Buchanan's species, I suspect they are the same; though he has not noticed the peculiarity of the head.

The following species are without suborbital spines, and have six cirri, except when the contrary is mentioned.

Spec. C. scaturigina,* Buch. t. 53. f. 6. β

Ventrals round, irregular cross bars on the sides, interrupted at the lateral line.

Spec. S. subfusca, J. M. t. 53. f. 5.

Ten regular brown zones encircling the body. D.11: P.11: V.7: A.7: C.17.

HAB. Assam.

Spec. S. punctata, t. 53. f. 4.

C. corica, Buch. P. G. Coll.

A row of spots on each side, and another along the back. D.9: P.11: V.7: A.6: C.19.

HAB. North-eastern parts of Bengal.

Variet. D.10: P.11: V.9: A.7: C.19.

HAB. Assam.

Spec. S. zonata, J. M. t. 53. f. 1.

Eleven dark green bars cross the body, with light green zones between them. D.11: P.11: V.8: A.6: C.17.

HAB. Assam.

Spec. C. savona, Buch. t. 53. f. 3. β

Body compressed, dusky black above, with narrow yellow bars. D.10: P.10: V.6: A.6: C.—?

HAB. Northern parts of Bengal.

* This species is not referred to in the Gangetic Fishes, though figured in Buchanan's collection of drawings: to me it seems to be nearly allied to *S. subfusca*, but its fins appear larger.

Spec. S. rupecula, J. M. t. 57. f. 3. J. A. S. vol. vii. t. 55. f. 3.

About fourteen bars across the body, and three on the caudal ; pectorals and ventrals round. D.8 : P.10 : V.8 : A.7 : C.16.

HAB. Mountain streams at Simla. Dr. Macleod's Coll.

Variet. Thirteen rings round the body. D.9 : P.12 : V.8 : A.6 : C.17.

HAB. Stagnant pools in Upper Assam.

The more prominent characters only of each group and species being brought forward in the above classification, it is necessary in another part of the paper to enter more fully into particulars regarding the different species ; but the want of any museums or collections of fishes, public or private, in India, and the difficulty of preserving them in such a climate, are obstacles that have rendered the undertaking less complete than it ought to be. We may however hope, from the zeal evinced in different parts of India in favour of this untrodden branch of Natural History, that the subject will not be allowed to rest, until we have a perfect knowledge of all our fresh-water fishes, as well as of the particular family here but superficially noticed.

DESCRIPTION OF PLATES.

PLATE LIV.

- Fig. 1. Upper side of the right ramus of the lower jaw of *Cyprinus semiplotus*, J. M. Fig. 2, the same of *Cyprinus mrigala*, Buch. Fig. 3, the same of *Cyp. bata*, Buch. *a*, the point of union with its fellow at the symphysis; *b*, the articulating surface behind. Figs. 4, 5, 20, and 21, represent the lower side of the left ramus of the lower jaw in the Cirrhins; *b*, the articulating surface behind, and *a*, the point of approximation with its fellow in front, where instead of a symphysis the two bones are attached by ligaments. Fig. 6, the lower jaw of the Barbels, *c*, side view of the left limb of *Barbus hexastichus*, D, under side of the same; *a*, symphysis, *b*, articulating surface behind.
- Fig. 7. Side view of the skull of spined Loaches; *a*, suborbital spine erect; *b*, in its situation when concealed in the sinus. D, spine twice its natural size; *c*, its natural size.
- Figs. 8, 9, 10, and 11. General form and disposition of the stomach and intestines in *Pæonominæ*. Figs. 12, 13, 14, and 15, general form and disposition of the stomach and intestines in *Sarcoborinæ*; *a*, being the entrance to the stomach from the mouth, and *b*, the vent. Fig. 8, stomach and intestines of the Cirrhins. Fig. 9, stomach and intestine of the Barbels. Fig. 10, stomach and intestines of the Gudgeons. Fig. 11, stomach and intestines of the Gonorhynchs.

Fig. 12. Stomach and intestine of the *Systemys*; fig. 13, of the *Perilampus*; fig. 14, of the *Leuciscus*; and fig. 15, of the *Opsarion*. In this last genus the alimentary canal is merely divided into stomach and cloaca.

Fig. 16. Stomach and intestine of *Platycaura maculata*; fig. 17, stomach and intestine in the genus *Cobitis propria*; fig. 18, the same in *Schistura*.

Fig. 19. *Perilampus thermophilus*, J. M. The caudal fin in the only two specimens I received is imperfect.

PLATE XXXVII.

Fig. 1. *Catastomus dyocheilus*, J. M. *Goreah* of the Assamese; about one-fifth of the natural size.

Fig. 2. *Cyprinus semiplotus*, J. M. *Senturee* of the Assamese; with a figure of the head, natural size.

PLATE XXXVIII.

Fig. 1. *Cyp. mrigala*, Buch. One-fifth the natural size, from a living specimen in Assam. This is one of the species figured by Buchanan, *Pisc. Gang.* t. 6, 79, but there is such a want of character in the figure alluded to that I am induced to submit another, the accuracy of which may be put to the test in any of our fish markets in Bengal.

Fig. 2 β. *Cyp. cursa*, Buch. This figure is taken from Buchanan's Collection.

Fig. 3. *Cyp. cursis*, Buch. Drawn half size from a dried specimen. I afterwards found a far better figure of this species in Buchanan's collection. It is very nearly allied to *Cyp. cursa*, fig. 2;—both are distinguished by their small scales and the flesh being full of small bones. Fig. 4 is the air vessel, the anterior cell of which is double.

PLATE XXXIX.

Fig. 1. *Oreinus guttatus*, J. M. Drawn the natural size of a specimen brought down from Boutan by Mr. Griffith. It belongs to the new sub-genus of Mountain Barbels; but the minute serrations on the hinder margin of the first ray of the dorsal fin are not shown in the figure, and the cross lines on the lower parts of the body are not natural, having been occasioned by keeping in spirits.

Fig. 2. *Barbus hexastichus*, J. M. An important species, inhabiting most of the large rivers in the north-eastern parts of Bengal. Its colours are probably subject to variation; but during the cold season all I met with in Assam were as represented in the drawing, which is about one-fifth of the natural size of the fish.

Fig. 3. *Barbus deliciosus*, J. M. Half the natural size.

Fig. 4. *Barbus spilophilus*, J. M. Half size from a specimen in spirits, found by Mr. Hodgson, and presented by him to the Asiatic Society; it is probably the *Cyp. chagunio* of Buch. The two long filaments in the anal are only, I suspect, an individual peculiarity.

PLATE XL.

Fig. 1. *Gobio bicolor*, J. M. Natural size.

Fig. 2. *Gobio anisurus*, J. M. Natural size;—both are *Bangons* of the natives.

Fig. 3. *Cyp. curchius*, Buch. Half size; it is very nearly allied to Fig. 2, Pl. 38.

Fig. 4. *Oreinus progastus*, J. M. Half size. A characteristic, but not well executed figure of a species said to be poisonous; it is very common in the rapids of the Bramaputra, where it is called *Adoee* by the natives of the neighbouring parts of Assam, to whom it is well known.

PLATE XLI.

Fig. 1. *Cirrhinus macronotus*, J. M. This is a large species, nearly allied to *Cyp. nandina*, Buch. P. G. t. 8. f. 84, and very common during the cold season in sandy streams in Assam, where it attains a great size and weight. It is a species that might be extensively propagated in ponds in all parts of India, and together with other herbivorous Cyprins might be rendered much more abundant by merely destroying the *Siluridæ* and Pikes, with which all the waters in the interior abound.

Fig. 2. *Cyp. rohita*, Buch. *Ruee* of the natives; no less celebrated in India than the Carp in Europe. It is the fish described by Buchanan, though not the one he has figured as the *Ruee*, the principal difference being in the form of the mouth. The various slight modifications of form under which the *Ruee* appears, prove the extent to which this species must have, at one period, been propagated in India. It is one of the largest and most abundant fishes in all parts of the country.

Fig. 3. *Barbus hexagonolepis*, J. M. *Bokar* of the Assamese; a large species very common. It is generally dark brownish on the back, bluish below, and on the opercula, and the scales and opercula are illuminated with yellow.

PLATE XLII.

- Fig. 1. β *Cyp. pangusia*, Buch. Fig. 2. *Aplocheilus chrysostigmus*, J. M.
 Fig. 3. *Aplocheilus melastigmus*, J. M. Fig. 4. β *Cyp. pausio*, Buch.
 Fig. 5. *Leuciscus brachiatus*, J. M. Fig. 6. β *Cyp. joalius*, Buch.

PLATE XLIII.—GONORHYNCHUS.

- Fig. 1. *Gonorhynchus gobioides*, J. M. Fig. 2. β *Cyp. lamta*, Buch. Fig. 3. β
Gon. fimbriatus, J. M. Figs. 4, 5. *Gon. rupeculus*. Fig. 6. β *Gon.*
gohama, Buch. Fig. 7. *Gon. macrosomus*, J. M.

PLATE XLIV.—SYSTEMUS.

- Fig. 1. *Systomus pyropterus*, J. M. Fig. 2. β *Syst. leptosomus*, J. M. Fig. 3.
Syst. tetrarupugus, J. M. Fig. 4. β *Cyp. gelius*, Buch. Fig. 5. *Syst.*
immaculatus, J. M. Fig. 6. β *Cyp. canius*, Buch. Fig. 7. β . *Syst. gib-*
bosus, J. M. Fig. 8. β . *Cyp. conchoniis*, Buch. Fig. 9. β *Syst. mala-*
copterus, J. M.

PLATE XLV.—PERILAMPUS.

- Fig. 1. β *Perilampus reticulatus*, J. M. Fig. 2. β *Cyp. devario*, Buch. Fig. 3.
Peril. ostreographus, J. M. Fig. 4. β *Peril. guttatus*, J. M.

PLATE XLVI.—PERILAMPUS.

- Fig. 1. β *Perilampus striatus*, J. M. Fig. 2. β *Peril. recurvirostris*, J. M.
 Fig. 3. β *Cyp. sutiha*, Buch. Fig. 4. *Peril. psilopterus*, J. M. Fig. 5.
Peril. perseus, J. M. Fig. 6. β *Peril. macropterus*, J. M.

PLATE XLVII.—OPSARIUS.

Fig. 1. *Opsarius gracilis*, J. M. Fig. 2. *Ops. pholicephalus*, J. M. 2a, air vessel of this species reversed. Fig. 3. *Ops. leucerus*, J. M. Fig. 4. *Ops. maculosus*, J. M.

PLATE XLVIII.—OPSARIUS.

Fig. 6. *Opsarius brachialis*, J. M. Fig. 7. *Ops. latipinnatus*, J. M. with its air vessel. Fig. 8. β *Ops. anisocheilus*, J. M. Fig. 9. β *Ops. fasciatus*, J. M. Fig. 10. β *Ops. albulus*, J. M. Fig. 5. β *Ops. megastomus*, J. M.

PLATE XLIX.—PLATYCARA.

Fig. 1. *Balitora brucei*, Gray, Fig. 2. *Platy cara maculata*, J. M. Both these figures are taken from Hardwicke's Illustrations, in consequence of the important light their singular forms cast upon the affinities of the whole family.

PLATE L.—PSILORHYNCHUS.

Fig. 1. β *Psilorhynchus sucatio*, J. M. The figure of this remarkable species is from Buchanan's collection.

Fig. 2. β *Psilorhynchus variegatus*, J. M. Also from Buchanan's collection. I have never met with either of these species.*

* Since this and other remarks on the same subject (page 248) were written, I have been favoured with a small collection of fishes from Captain Hormay of Upper Assam, in which I find one specimen of *Psil. variegatus*, a description of which will appear in a subsequent part of this paper.

PLATE LI.—COBITIS.

Fig. 1. β *Cobitis oculata*, J. M. Fig. 2. β *Cob. cucura*, Buch. Fig. 3. β *Cob. guntea*, Buch. Fig. 4. β *Cob. bimucronata*, J. M. Fig. 5. *Cob. cinnamomea*, J. M. Fig. 6. β *Cob. ocellata*, J. M. All these figures are from Buchanan's collection of unpublished drawings; the first, third, fourth, and sixth species are in my collection also, but as Buchanan's figures are better than mine, I give them the preference.

PLATE LII.—COBITIS.

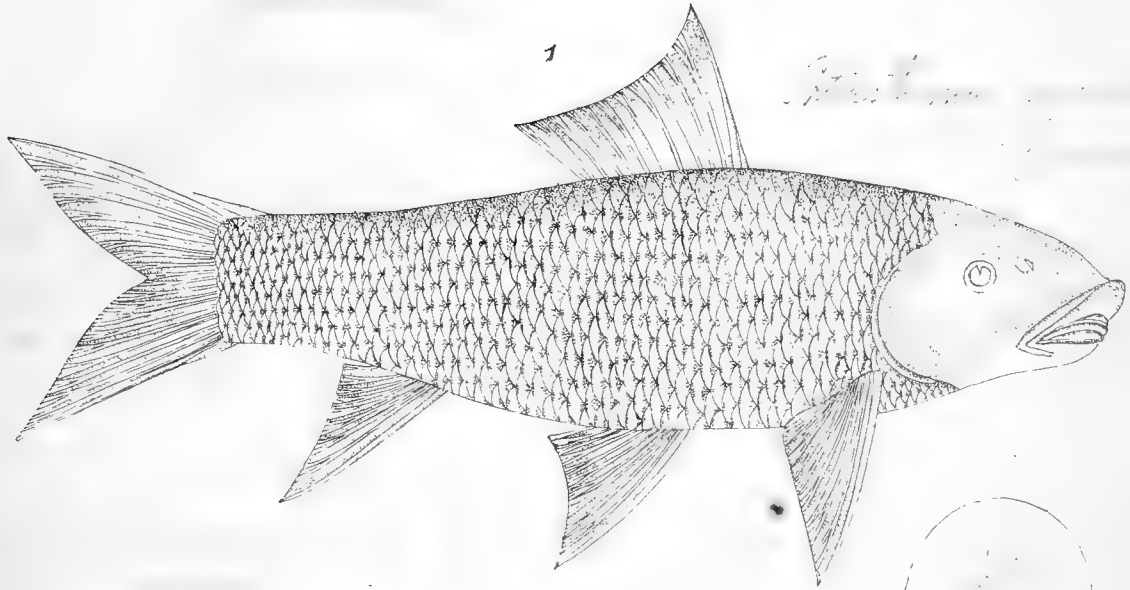
Fig. 1. *Cobitis pavonacea*, J. M. Fig. 2. *Cob. monocera*, J. M. Fig. 3. *Cob. chlorosoma*, J. M. Fig. 4. *Cob. phoxocheila*, J. M. Fig. 5. *Cob. guttata*, J. M. fig. 6. head of the same magnified, showing the cirri to be four, on which its specific character rests. Fig. 7. β *Cob. gibbosus*, J. M.

PLATE LIII.—SCHISTURA.

Fig. 1. *Schistura zonata*, J. M. Fig. 2. β *Cob. balgara*, Buch. Fig. 3. β *Cob. savona*, Buch. Fig. 4. β *Schist. punctata*, Fig. 5. *Schist. subfusca*, J. M. Fig. 6. β *Cobitis scaturigina*, Buch.

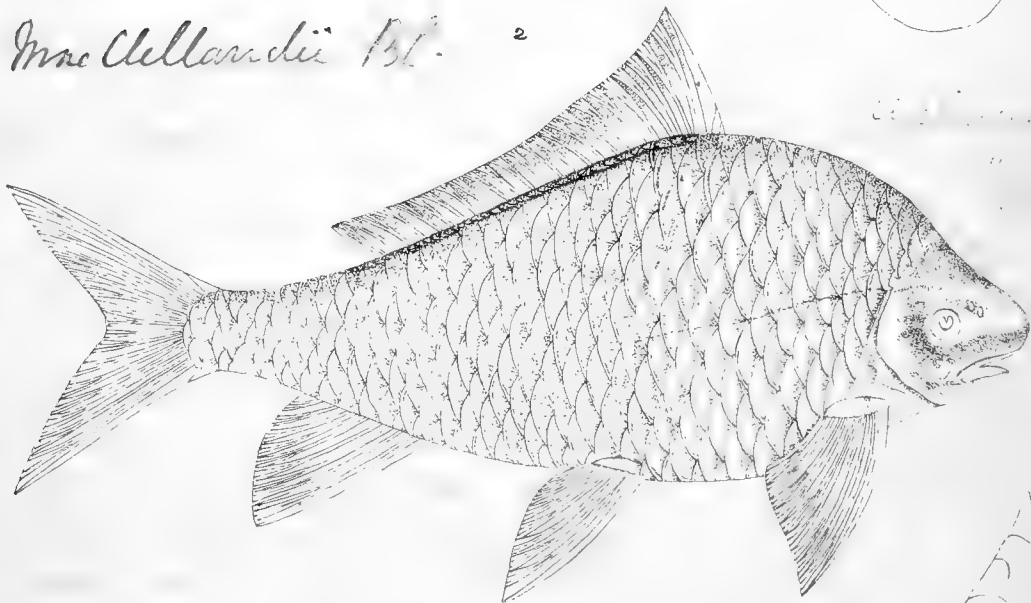
PLATE LV.

Fig. 1. *Gobio ricnorhynchus*, J. M. Fig. 2. *Barbus macrocephalus*, J. M. Fig. 3. *Gob. limnophilus*, J. M. Fig. 4, is a species of the curious genus *Aplocheilus* figured in Buchanan's collection, but not named on the drawing, or alluded to in the Gangetic Fishes; nor has the species itself been met with by me. It differs apparently from the two I have described, in the greater depth of the body, as well as in other characters, which, however, it would be unsafe to derive from the figure alone. Fig. 5. *Gobio lissorhynchus*, J. M.



Semiplotus MacClellandii Bl.

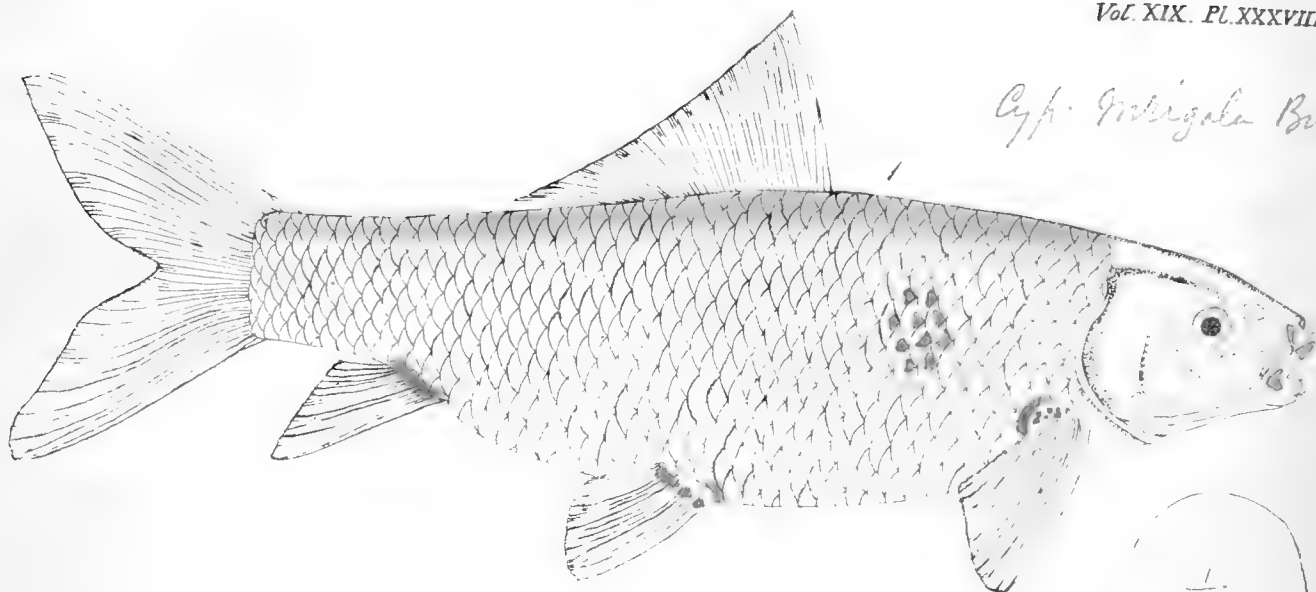
2



J.M. del.

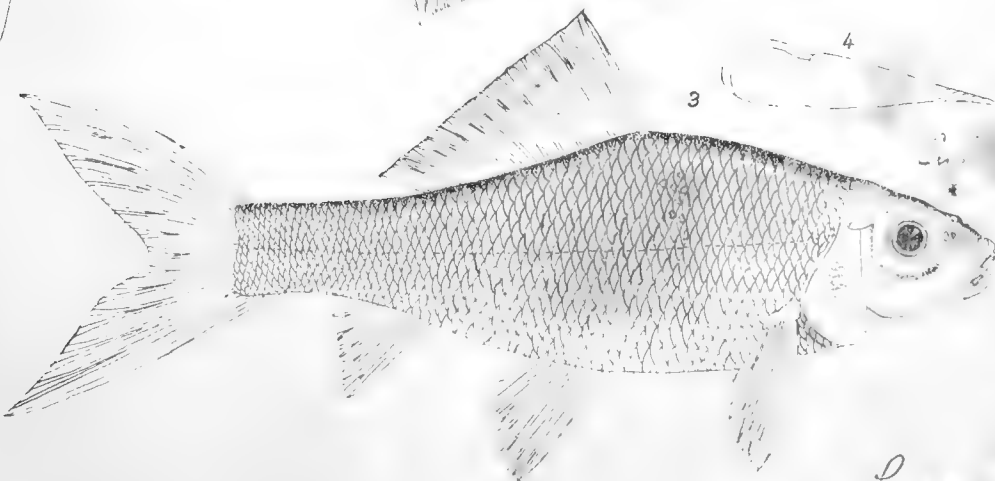
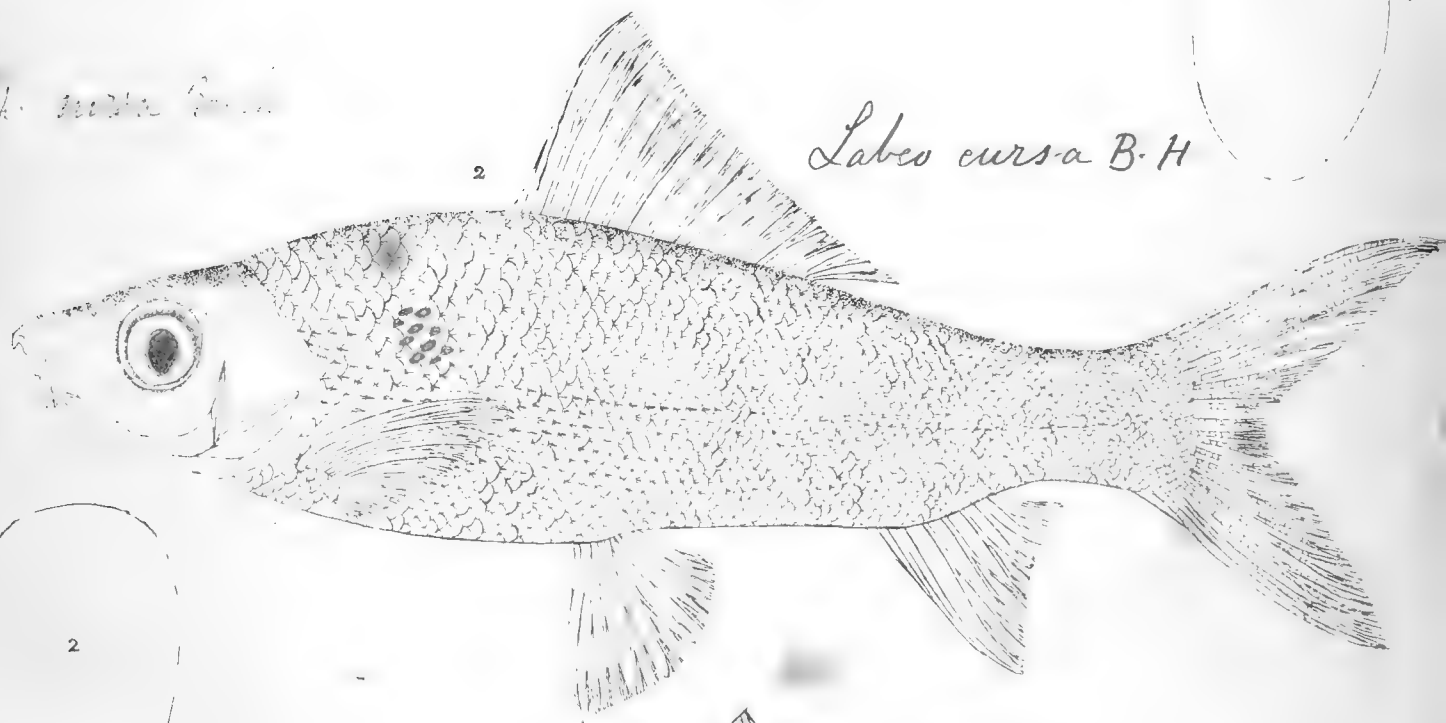
Cirrhinia mrigala B. H.

Cyp. mrigala Buch.



Cyp. mrigala Buch.

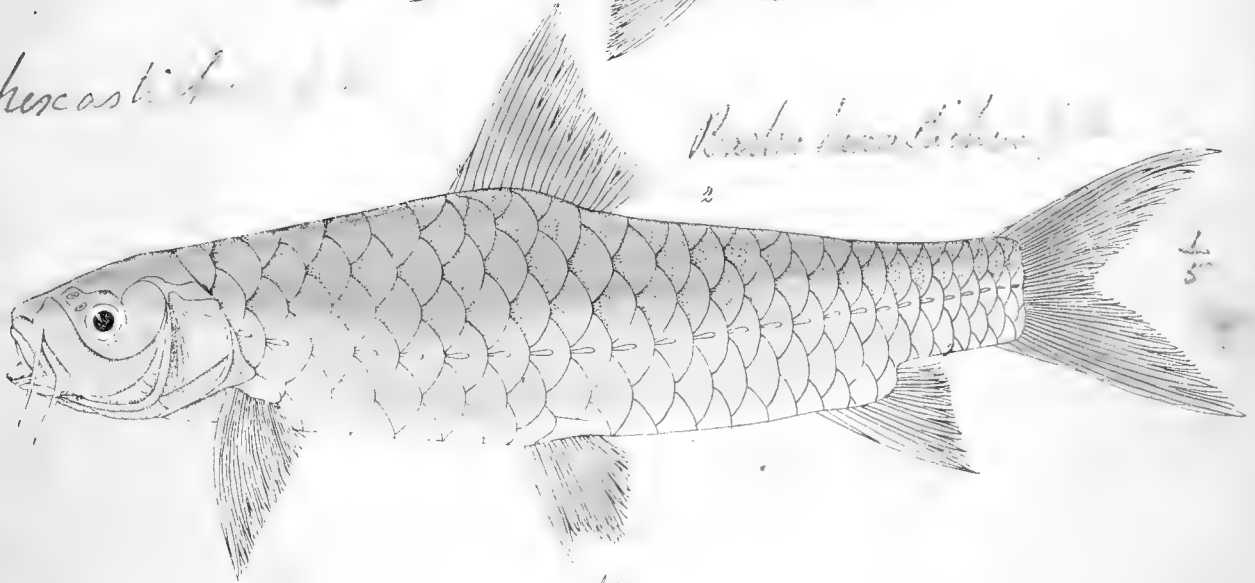
Labeo cursa B. H.



L. cursa B. H.

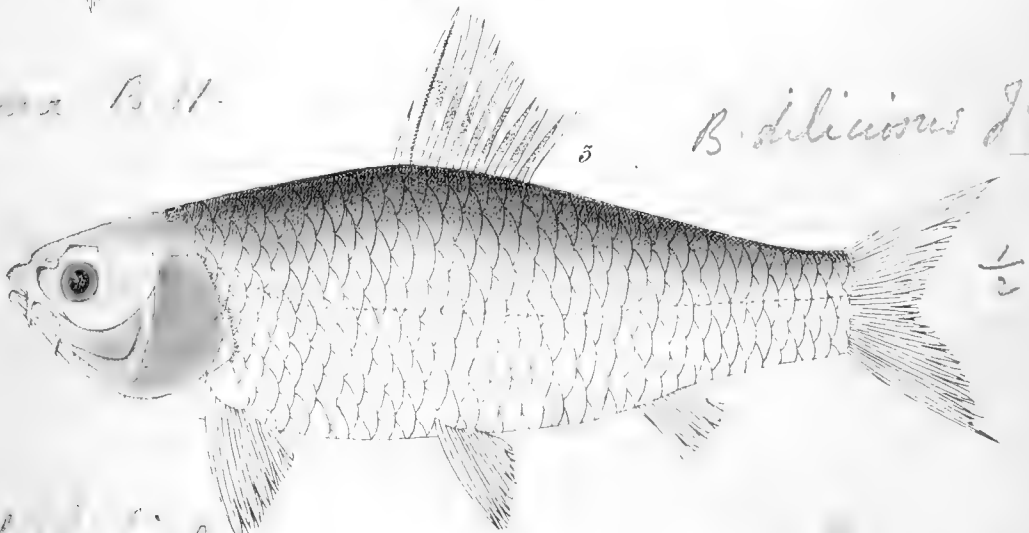


Barbus hecastictus



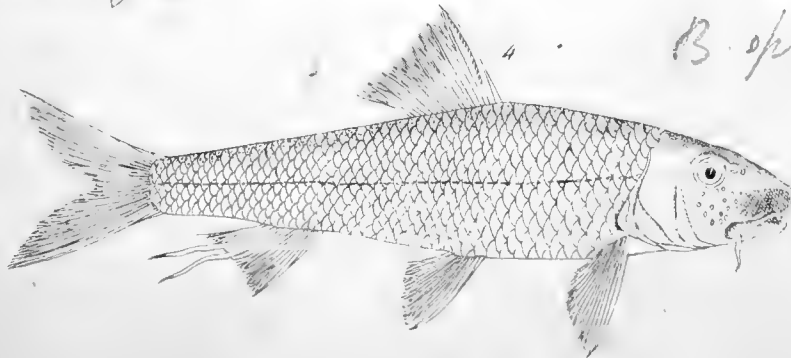
Barbus haasi

Barbus serratus B.H.



B. deliciosus Jm.

Barbus spilargenteus Jm.

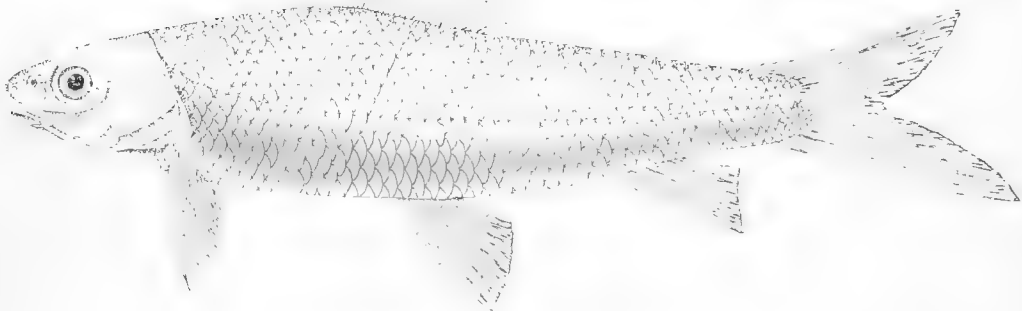


B. spilargenteus Jm.

Cypr. chaguis B.H.



Cirrharus strimmarum J.N.

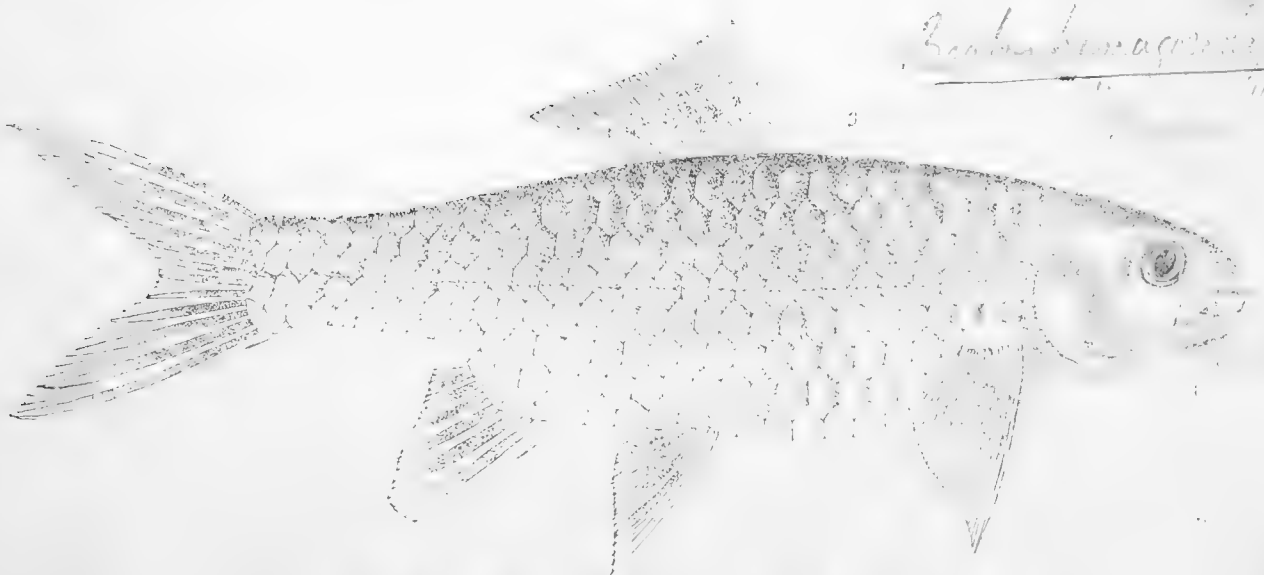


Labeo cirrhatus



prostratus.





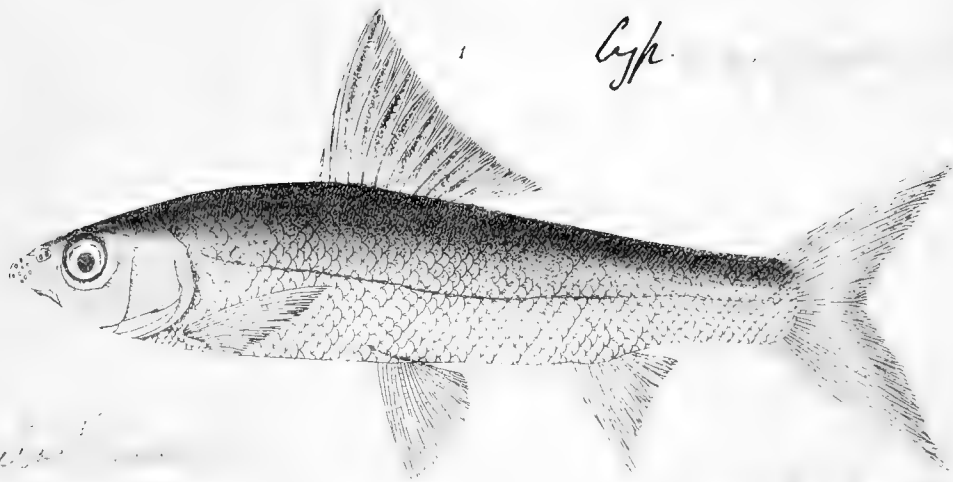
J. N. S.

Barchius lanceolatus J. N. S.

Printed at the Oriental Lith. Press Calcutta

Cyp.

Hau.



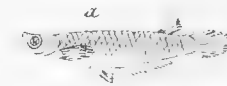
A. melanocephalus



3



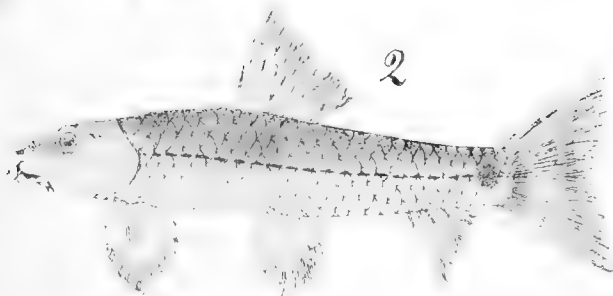
2



Cyp. melanocephalus Bach.



Barilius coeca Bach. Hau.



Crossocheilus sada Burd. Har.



Crossocheilus (Bm) grahami Burd. Har.



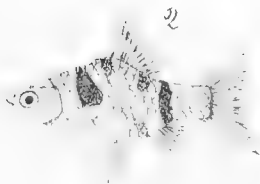
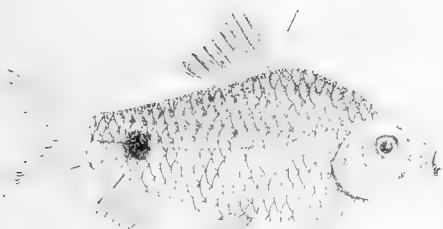
C. nana



Crossocheilus latius Burd. Har.

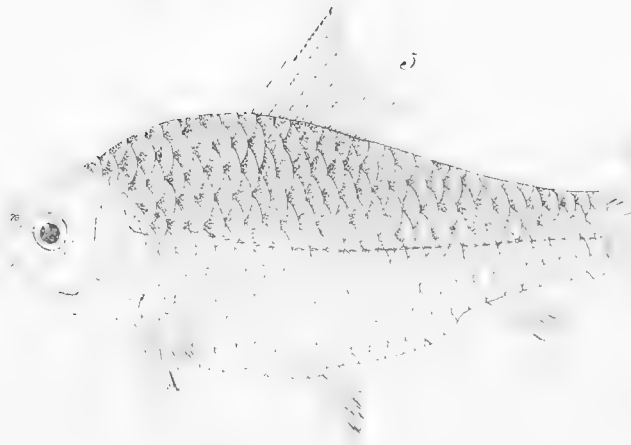
Barbus (phuturis)

B. arbutus B. H.



Barbus

(phuturis)



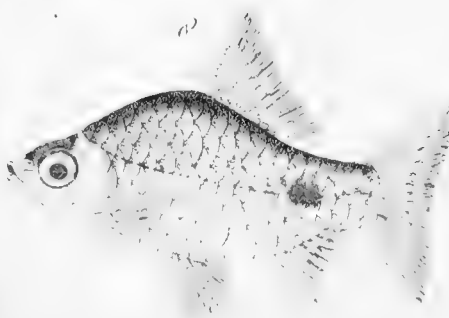
B. gelius B. H.



Barbus tenuis B. H.

Barbus (phuturis)

Barbus cosuatis B. H.

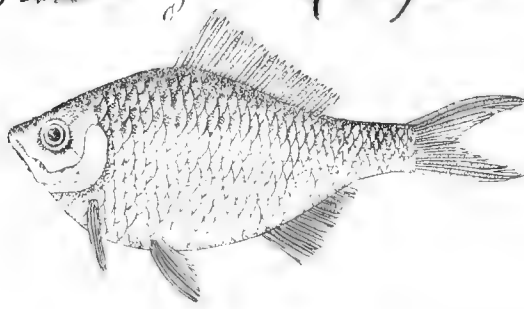




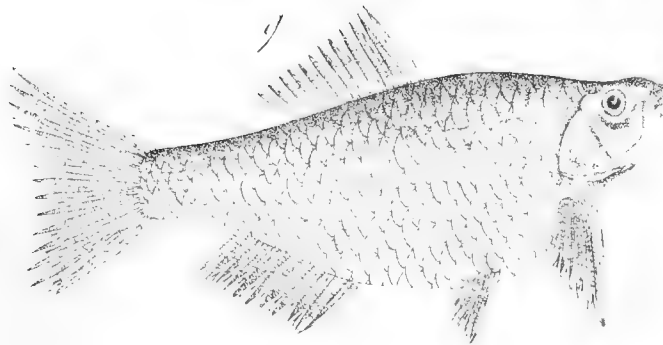
Perilampus utinomela (n) *Danio daughila* B.H.



Danio (n) *devaris* Bud. Han



D. utinomela 9



Chela laubuca B.H.



Boulengeria nana B. H.

Boulengeria nana



Nurina danrica B. H.

Nurina danrica



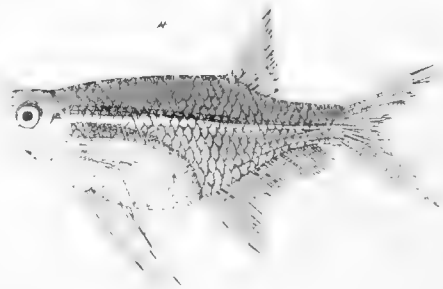
Nurina danrica B. H.

Nurina danrica



Cachius atpar.

Cachius atpar.



22

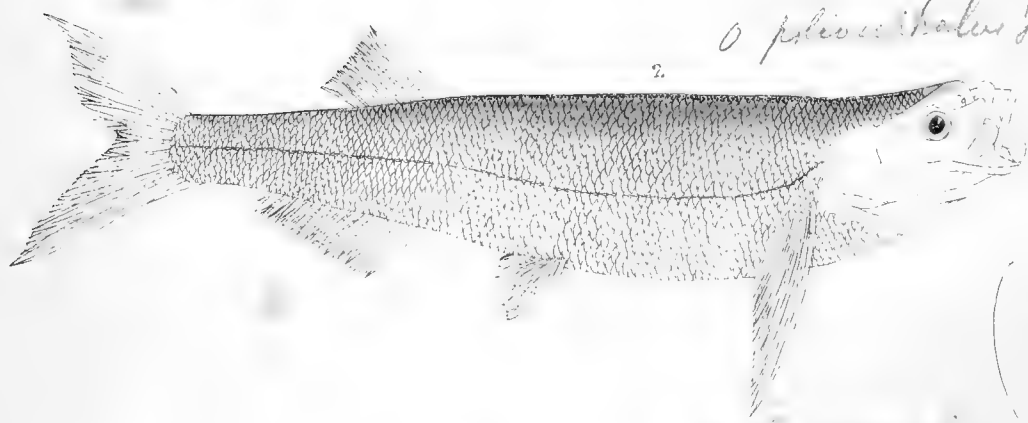
O. gravis L.



1

20

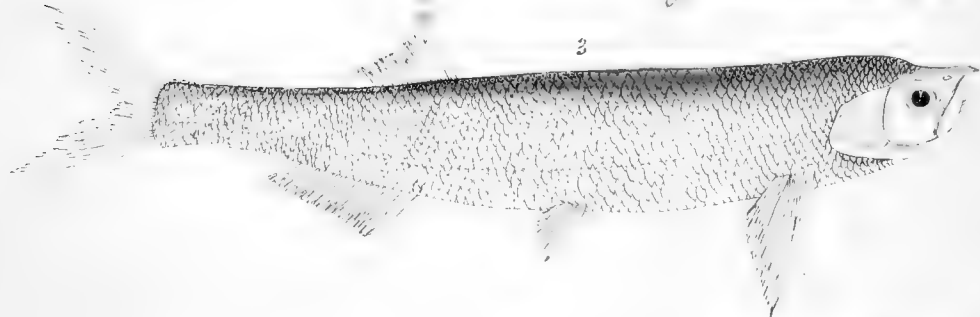
O. pleurochilus L.



2

O. lineatus L.

3



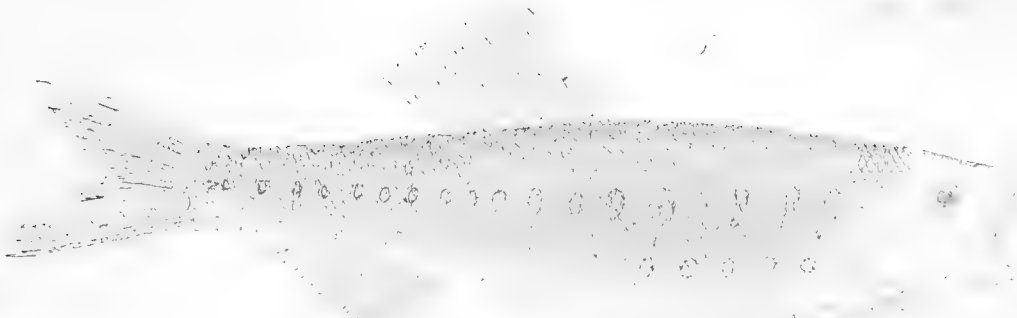
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O. maculosus L.

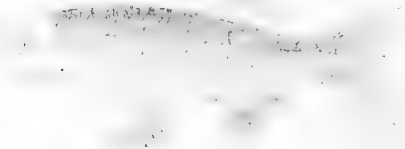
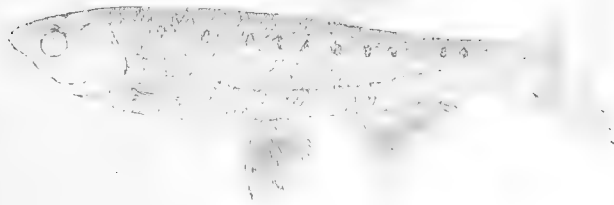
4



4

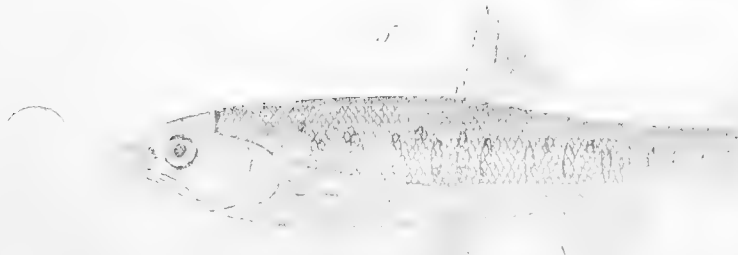
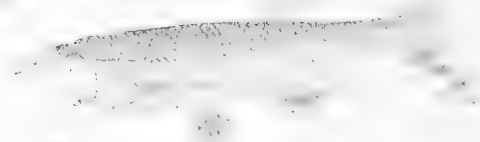
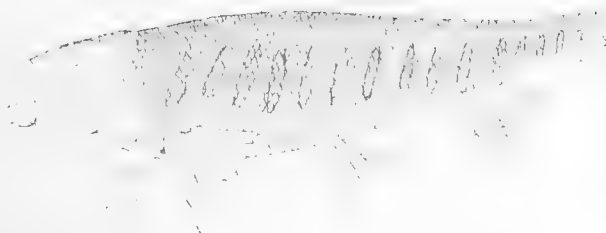


Barilius barila B.H.
amurensis



latidorsalis

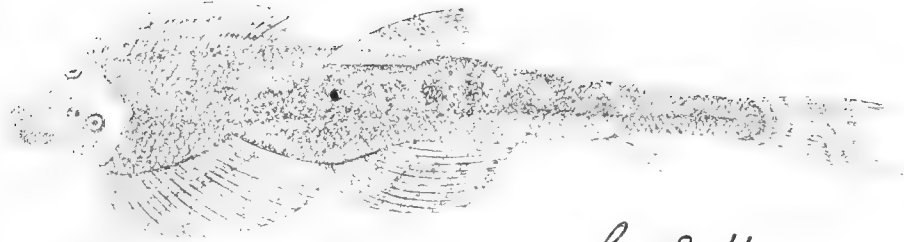
Cula B.H.



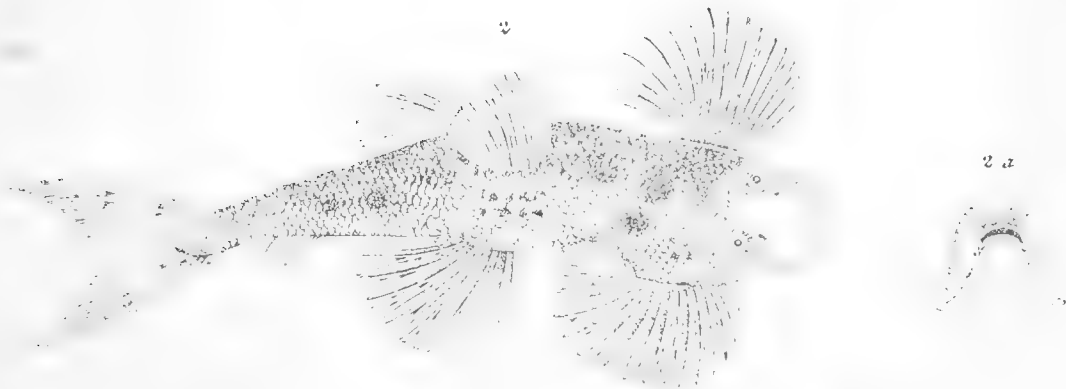
Homatoptera. v Hassel

As. Rec.

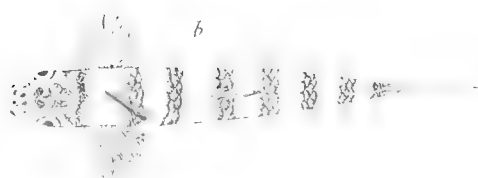
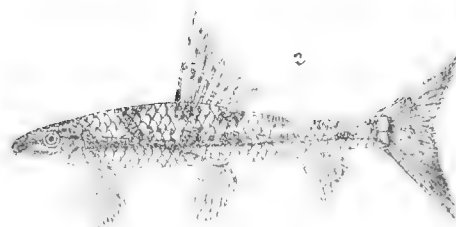
Vol. XIX. PL. XLIX



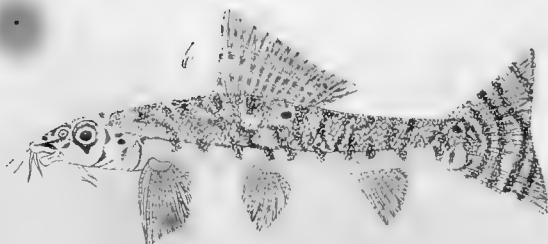
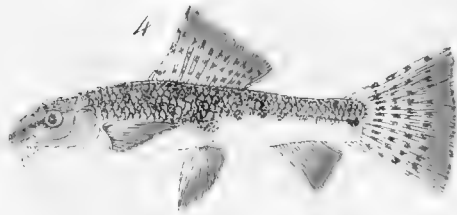
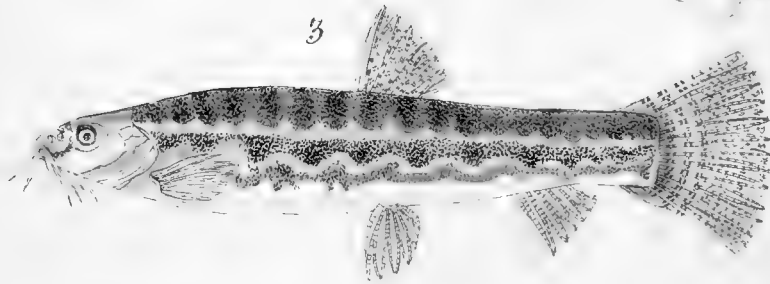
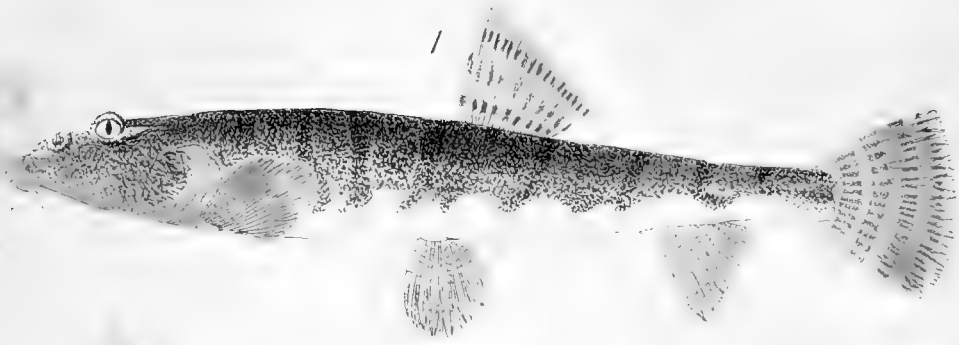
H. Brucei G. & H.



H. maculata G. & H.



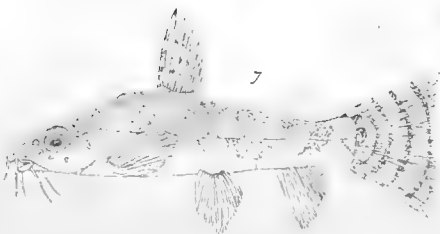
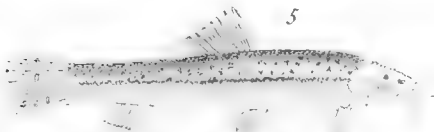
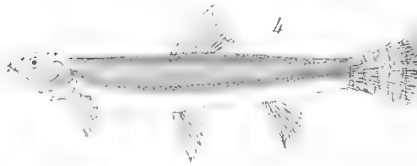






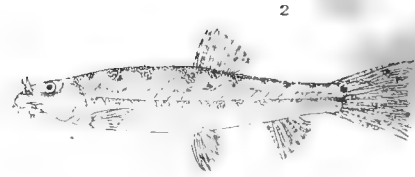
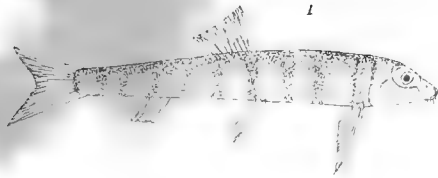
C. lat.

C. kaurana 1/4





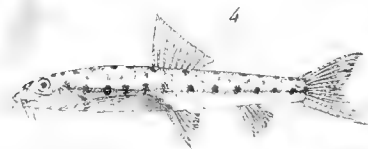
Salm. gairdneri



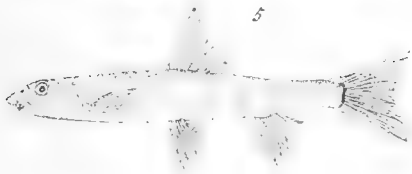
Ch. sonna



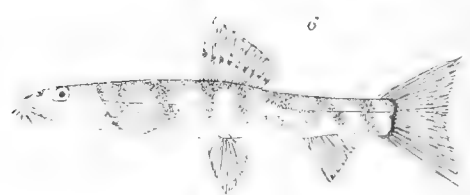
Ch. punctata



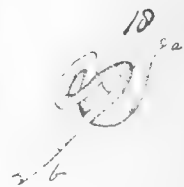
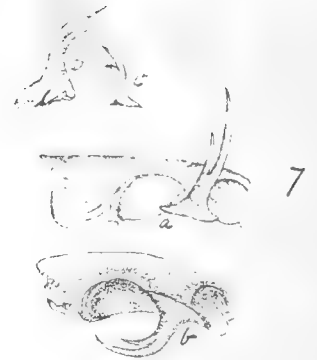
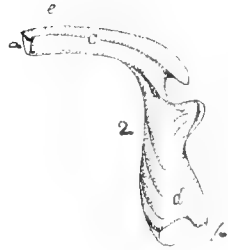
Ch. californica



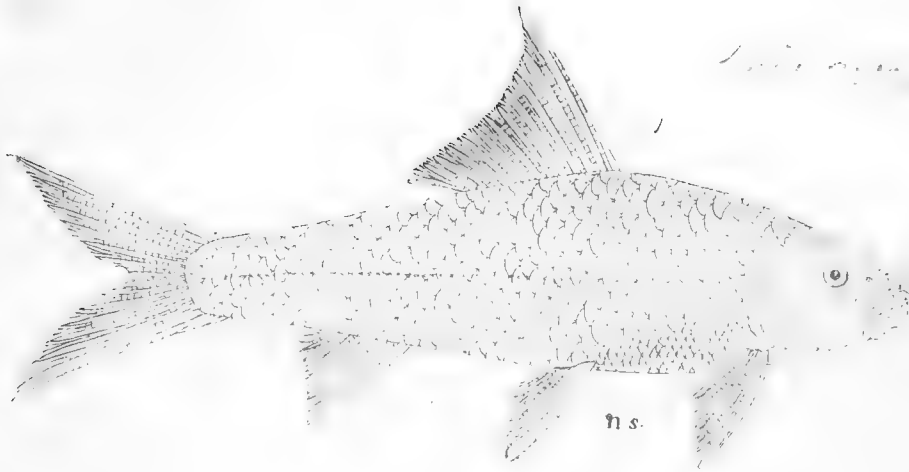
Ch. californica



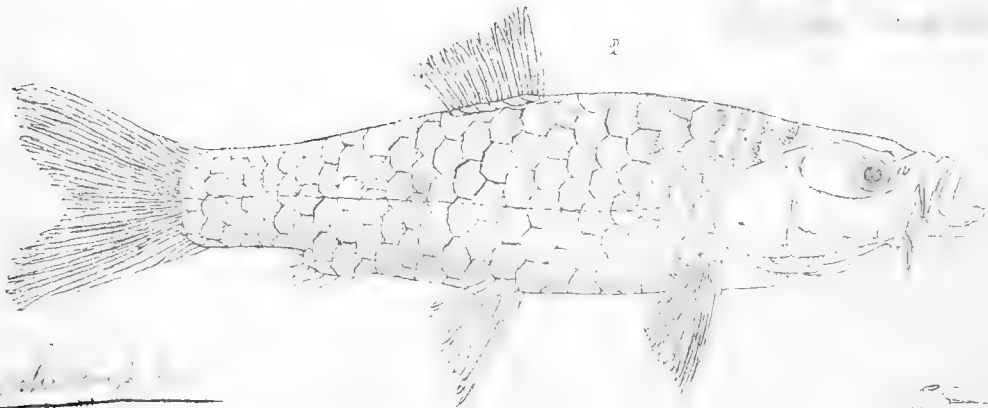




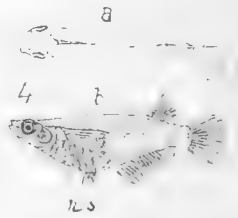
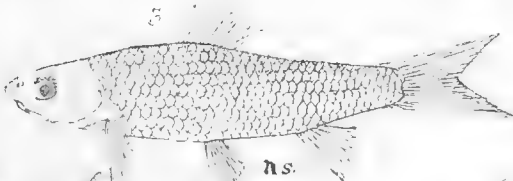




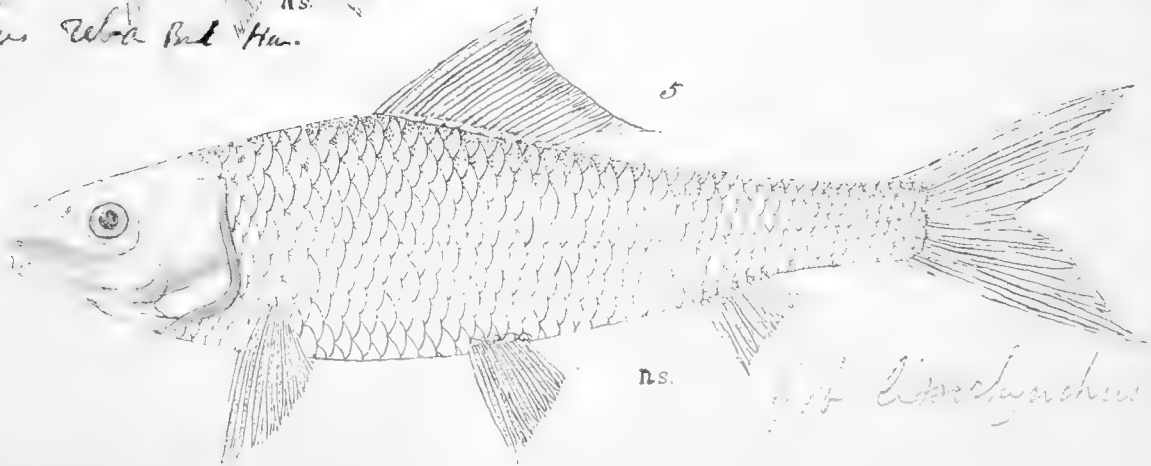
Leuciscus leuciscus L.



Leuciscus leuciscus L.



Crossocheilus teleostei Hm.



Leuciscus leuciscus L.



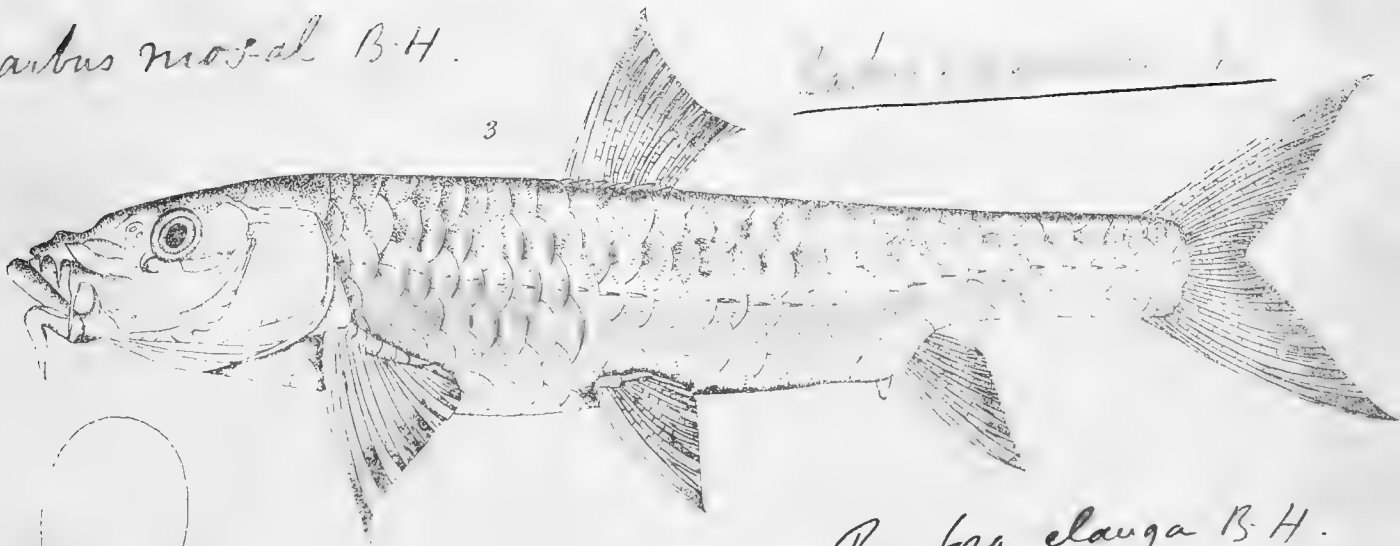
Myxine punctata B.



Myxine punctata B.



Barbus mosal B.H.



Barbus mosal B.H.

Rasbora clausa B.H.

Rasbora clausa B.H.



Rasbora clausa B.H.



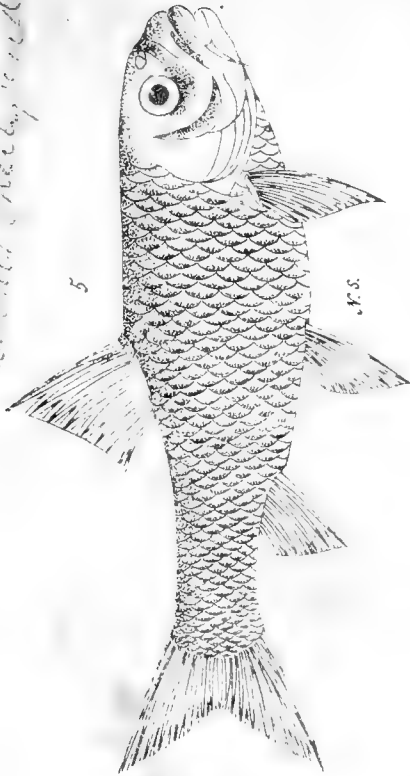
Ichaera cincta B.H.

As. Res.

Laccosoma elongatum p. 13



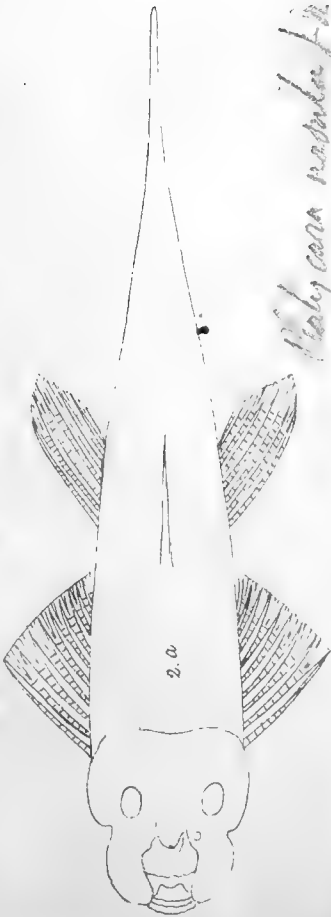
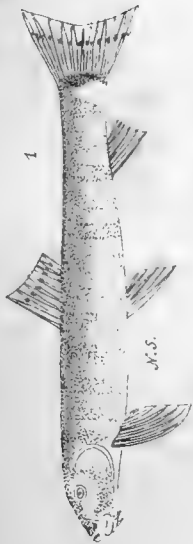
Bombus chalybeius p. 14



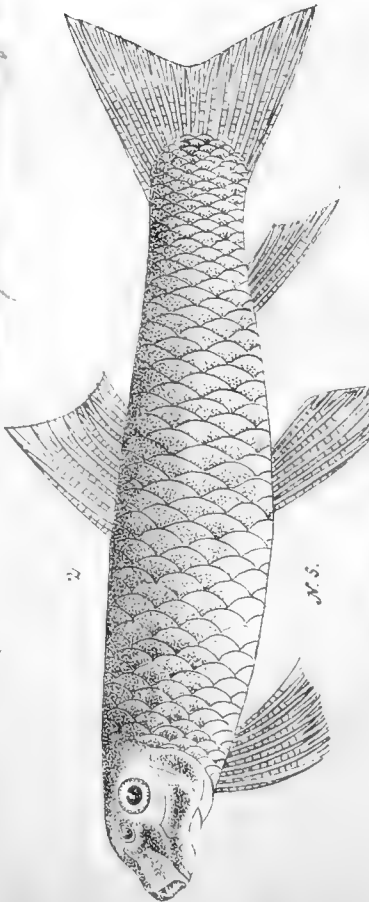
Cyclops maculatus p. 15



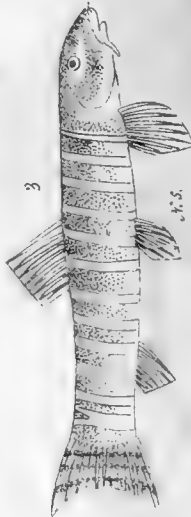
Leuciscus punctatus p. 12



Platycephalus punctatus p. 16



Leuciscus punctatus p. 17



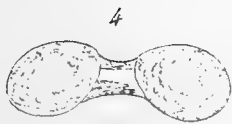
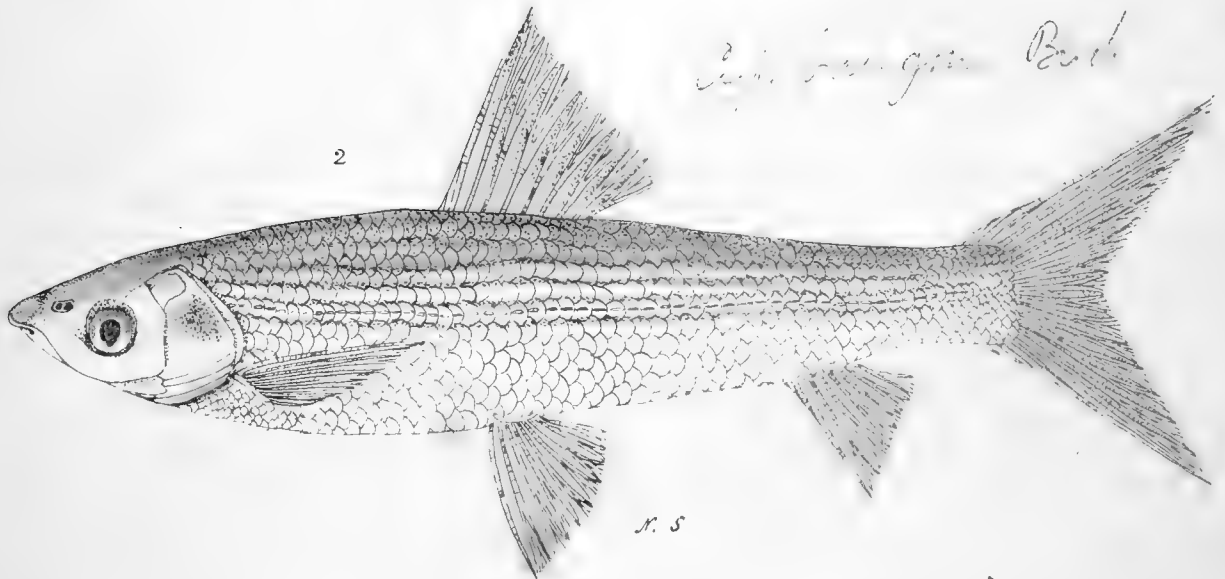
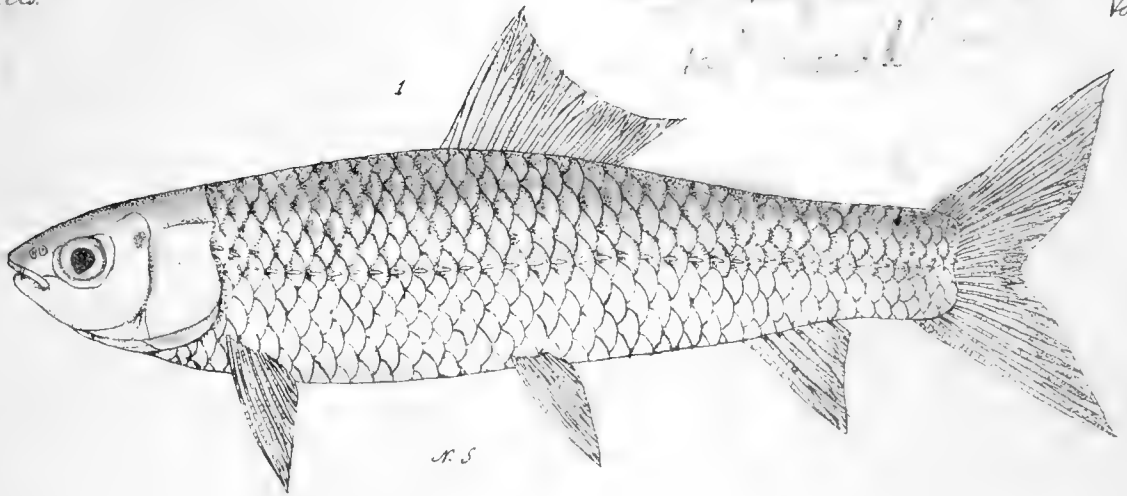


PLATE LVI.

Fig. 1. β *Opsarius isocheilus*, J. M. Fig. 2. β *Lenciscus margarodes*, J. M.
Fig. 3. *Barbus progeineus*, J. M. Fig. 4. *Leusiscus dystomus*, J. M.
natural size. Fig. 5. β *Opsarius cirratus*, J. M.

PLATE LVII.

Fig. 1. *Schistura montana*, J. M. Fig. 2. *a, b, Platycara nasuta*, J. M.
Fig. 3. *3 a, Schistura rupecula*, J. M. Fig. 4. *Leuciscus elingulatus*,
J. M. Fig. 5. *Barbus cheilynoides*, J. M. Fig. 6. *Oreinus macu-*
latus, J. M.

PLATE LVIII.

Fig. 1. *Cyprinus mrigala*, Buch., or that variety called *Rewah* by the Ben-
galese. Fig. 2. β *Cyp. bangon*, Buch. Fig. 3. β *Cyprinus chola*,
Buch. Fig. 4, the air vessel as it occurs in the smaller species of
Schisturæ. Fig. 5, as it occurs in *Cobitis propria*, J. M.

The remaining plates, chiefly representing the structure of the scales of
nearly allied species, will be afterwards described.

ACCOUNT OF SPECIES.

CIRRHINUS MACRONOTUS, J. M.

t. 41, f. 1.

This is a large wholesome fish, much resembling the European Carp, but without the dorsal spine of that species. It is very nearly allied to Buchanan's *Cyp. nandina*, but has three rays less in the dorsal fin, and other slight peculiarities, which may however be mere variations arising from artificial propagation, or other causes.

The length of the head to that of the body, exclusive of the head and caudal fin, is as one to four, and the greatest depth is equal to one-third of the length. The dorsal fin commences at the most prominent part of the back, at a distance from the head equal to about a third length of the body, and extends to within half such distance from the caudal.

The ventrals are placed in the middle of the body, somewhat behind the commencement of the dorsal and the anal, on the posterior third of the space between the ventrals and the insertion of the caudal. The base of the dorsal fin is equal to nearly twice the length of the head; the first of its rays is scarcely half the length of the second, but all the rays are comparatively short, and the membrane of the fin thick and strong. The fin rays are,

D.23 : P.16 : V.9 : A.7 : C.19.

There are forty-one scales along the lateral line, and thirteen in an oblique row from the base of the ventrals to the back. The head is larger in every respect than that of *C. calbasu*, Buch., but shorter and blunter, as well as more bulky, than that of *C. rohita*, Buch. The posterior margin of the operculum is the segment of a circle whose centre is situated on the lower and posterior

corner of the orbit; the mouth is similar to that of *C. rohita*, except that it is a little smaller, and the two bony limbs of the lower jaw stronger, and their transverse apophyses more massive. See t. 54, f. 5.

Buchanan observed that a variety of *Cyp. nandina* occurs with twenty-three rays in the dorsal instead of twenty-six. The variety alluded to is no doubt the one here described; affinities run so close between several of the larger species of Cirrhins that it is only by comparison of many individuals, that we can arrive at satisfactory specific distinctions. This species was observed by Buchanan in the Goruckpur district, on the northern frontier of Bengal; the individuals I met with in Assam, in March, were found in sandy streams which they had entered probably for the purpose of spawning. They are seldom seen so high in the Bramaputra as the rapids, and never, I believe, so low as to come within the influence of the tides, which effect a change by the deposit of mud instead of sand, no less remarkable in the bottoms and banks of rivers, than in the character of the fresh water fishes which are found within their influence.

II.—CYPRINUS NANDINA, Buch.

Pisc. Gang. t. viii. f. 84. *Nandin* of the fishermen.

Length of the head compared to that of the body as one to three, forty-four scales along the lateral line, and twelve in an oblique line from the base of the ventrals to the dorsum, which is much arched. The dorsal commences on the most prominent part of the back, at a distance from the head, equal to the length of that organ. The fin rays are,

D.26 : P.16 : V.9 : A.7 : C.19.

The specimen from which this description is formed, was found by Mr. Griffith in the great jeels on the northern side of Bengal. I think I have met with it in the Bramaputra as high as Gowahattee, but it disappears where the currents become rapid, and the water more cool and clear. Buchanan found it very abundantly in the marshes adjacent to the ruins of the ancient

Gour, on the northern side of Bengal, where it usually attains two or three feet in length, and is a well flavoured and wholesome food. Its form, he says, is thick, but still slightly compressed, and the colour of the upper part of the body is dark green, with a coppery gloss; below it is white; the fins are dark, and the eyes red. Buchanan supposed that of all fishes he had met with in India, the *Nandin* has the greatest resemblance to the European Carp, but that many of its qualities are different; to this I may add, that it wants the dorsal and anal spines of *Cyprinus carpio*, while it differs from *Cyp. fimbriatus*, Bl. in having cirri, as well as a much longer dorsal.

III.—CYPRINUS CALBASU, Buch.

Op. Cit. Pl. 11. f. 83. *Kalbasu*, and *Kundna* of the fishermen.

It is stated by Buchanan that this species is closely allied to the Barbel of Europe; and Cuvier on his authority referred it to that genus, although it has neither the short dorsal, nor the spines of the Barbels. Buchanan's figure though tolerably characteristic, presents the operculum too much rounded, and in his description the dorsal is said to be straight above, although it is falciform, and the nostrils to have but one aperture on either side. Buchanan was aware of the existence of two varieties of this species, and it strikes me he has applied the description of one, to the figure of the other. The following seems to me to be the variety he has figured. General colour deep leaden blue, scales dotted, fins dark, lips pendulous and fimbriated, forty-two scales on the lateral line, fourteen in an oblique row from the base of the ventrals to the dorsum. Fin rays, D.15 : P.17 : V.9 or 10 : A.8 : C. $\frac{10}{8}$. There is yet a third kind, probably a distinct species, with red ventrals and forty scales along the lateral line, and twelve in an oblique row from the base of the ventrals to the dorsum.

The following is a description of the other, or ferruginous variety, *Kundhna* of the natives:—

The length from the operculum to the base of the caudal is four and a half lengths of the head, which is small and fleshy. The posterior margin of the operculum is equally rounded forming part of a circle, and the eyes are placed intermediate between the branchial aperture and the snout. The dorsal is placed somewhat nearer to the caudal than to the head, and forty-two scales are ranged along the lateral line, which is but slightly depressed over the pectorals; fifteen scales form each oblique line extending from the base of the ventrals to the dorsum on either side; the ventrals are placed a little behind the dorsal. The fin rays are,

D.16 : P.15 : V.9 : A.7 : C.20.

It is observed by Buchanan that in some places, as at Moonghyr where the Ganges is clear, passing over a pure sandy or rocky bottom, many of the scales assume a ferruginous colour, and the fish is supposed by the Natives to be a different species, which they call *Kundhna*, though he has no doubt this difference of colour is accidental. Buchanan farther remarks, that this species is very common in all the rivers and ponds of Bengal, and that it is also found in the Western Provinces about a foot and half in length, and sometimes even twice that size, and is a well flavoured light food, but contains many small bones. In general, Buchanan observes, it is of dark colour with a silvery gloss, inclining to yellow, and the scales are covered with numerous black dots. It is a very common fish in the Calcutta market.

IV.—CYPRINUS ROHITA, Buch.

Pisc. Gang. Pl. 36, f. 85, t. 41, f. 2.

The head of this species is a third longer than that of *C. calbasu*, and is equal to the depth of the body, while in the latter species the length of the head is little more than about half that depth. Before I was aware of the

existence of several varieties of this species, I thought Buchanan's figure the very worst imaginable, in as much as it does not correspond with his description; in proof of which it is only necessary to mention that although he correctly says the mouth extends straight backwards, i.e. horizontally, yet the figure places its orifice under the head half way between the snout and the eyes, as in the *Gonorhynchus*; but when the mouth of *C. rohita* is closed, the upper lip, which is rather thick and muscular, is drawn in front of the orifice of the mouth like a projecting snout. There is, however, a small sized variety very common in Calcutta, which corresponds very accurately in every respect with Buchanan's figure, while his description agrees with a larger fish, probably the one I have figured, though there are still other varieties, but they may all be considered as one species. The different characters which it presents are no doubt the result of domestication. The variety figured by Buchanan is constant in its characters, and may be described as having two minute cirri, one at either angle of the mouth; the length of the head is rather less than the depth of the body, which is almost equal to a third of the length. The back is green and gold coloured, diminishing on the sides; the upper part of the head, the dorsal, caudal, and anal are dark olive, the pectorals pale, ventrals red. There are forty-three scales on the lateral line, and twelve from the base of the ventrals to the dorsum. The fin rays are,

D.15 : P.16 : V.9 : A.7 : C.19.

This is the *Ruee* figured by Buchanan. The following description refers to the one I have figured which is much larger, and very common in Assam; and it seems to me that Buchanan's description applies more to the latter than the former variety. I have stated the rays of the anal to be eight, while Buchanan makes them seven; the last ray of that fin is usually double, and sometimes it is difficult to say whether there be one ray more or less than a given number.

The dorsal is placed equidistant between the head and caudal, its base is equal to the length of the head and to one third of the body, and there are forty-two scales along the lateral line, and thirteen in an oblique line from the ventrals to the back. The operculum is the segment of a circle whose centre is placed on the posterior margin of the post operculum, a peculiarity which belongs to none of the adjoining species, and the eye is placed considerably nearer to the snout than to the branchial aperture. The fin rays are,

D.15 : P.16 : V.9 : A.8 : C.20.

This species is common, Buchanan states, in the rivers of the Gangetic provinces as well as in those of Ava, and I may add Assam. It is propagated, he says, in ponds with considerable care, being a most valuable fish, and its beauty, he observes, both as regards its form and colours, equals its value for the table. The same praise may however be with almost equal justice bestowed on each of the preceding species, which are generally, with the exception of the *Calbasu*, sold under the same name ; and indeed the fishermen are perhaps the only natives who are acquainted with their distinctions. With regard to their importance, it may be observed that there are no animals of more extensive utility, as they are equally used by all castes and classes. I believe, however, that in the North Western Provinces they are scarce, yet there is no part of the plains of India into the waters of which they might not be introduced and propagated to the greatest extent. In any attempts that might be made to this end, it would be necessary to attend not only to specific, but also to sexual distinctions ; it may be sufficient in this place to remark that the abdomen in female fishes is usually larger than in the males, while in the latter the branchial aperture and gills are somewhat larger, as Mr. Yarrell states, than in the former.

Having pointed out the distinctions between the foregoing species with sufficient minuteness to enable any one to recognise them, I may notice a few points connected with their general appearance and structure. In colour they

differ little from each other, the back is dark green in *C. rohita* and *C. nandina*, but it approaches more to olive in one variety of *C. calbasu*, and in another to dusky blue; below the colours vary from yellowish to reddish white, the sides often presenting an ochrey or occasionally a coppery iridescence or gloss. In all, the fins generally are dark, and the rays composing the pectorals slender, while those of the ventrals and anal are more stout and coarse. After they are caught the eyes and skin covering the edges of the opercular plates become bloodshot, an appearance not to be taken for a natural colour.

Although, as appears in the description of each species, the head differs considerably in size, it may generally be described as short and conical, flattened slightly above. The mouth is small and circular, and when opened occupies the apex or anterior part of the head, but at other times a slightly muscular snout closes it in front; the lips and cirri are pendulous, and the former in particular are strong and muscular, and may be supposed to be used for collecting worms, loose seeds, and other detached objects from the bottoms of muddy waters, such as ponds, jeels, and sluggish rivers. Indeed the frequent examinations that I have made of the contents of their abdominal canal places the certainty of this beyond supposition, at the same time it is necessary to observe that vegetable substances constitute by far the largest proportion of their food, which would seem to be obtained by stirring the deposits at the bottom of stagnant waters by means of the snout and its appendages.

In *C. calbasu* the stomach is a lengthy sac gradually narrowing to the capacity of the intestine, which is extremely long and loaded with a grey opaque matter, which seems to change in its passage through the intestines to a leaden hue; sometimes the contents of the intestine are greenish, but I have seldom found the scales or testaceous parts of other animals in the stomach of any of these species.

The liver is a dark red coloured organ consisting of three elongated lobes, the gall-bladder is large, and the air vessel is divided into two cells, the posterior of which is smaller than the anterior.

V.—CYPRINUS GONIUS, Buch.

Op. Cit. Pl. 4, f. 82. *Goni* of the fishermen.

Snout very muscular and perforated with pores, scales minute, intestines larger than in the preceding species, and loaded with a green vegetable pulpy matter. The fins large, their rays are,

D.15 : P.17 : V.9 : A.7 : C.19.

Buchanan observes that this species is very tenacious of life and strong, attaining a foot and a half in length, though it is little valued as food. Above it is of dark green colour, and the sides are marked with longitudinal dotted lines presenting an analogy to the *Perilamps*.

VI.—CYPRINUS NANCAR, Buch.

Op. Cit. 299.

This species I have not met with, nor is there a drawing of it in Buchanan's collection; there can be no doubt, however, from the description given in the *Pisc. Gang.* that it belongs to the Cirrhins; the mouth is small, surrounded by thick crenated lips, the snout projects slightly in front of the mouth, the head is fleshy so as to conceal the bones of the operculum, which perhaps induced Buchanan to suppose the sub-operculum to be wanting, or that each operculum is formed of a single bony plate; in other respects it bears a resemblance to *C. rohita*, but the important peculiarity of the operculum and thick covering of the opercular plates, evince perhaps a closer affinity to *Catostomus dyocheilus*. The fin rays are,

D.20 : P.18 : V.9 : A.8 : C.20.

VII.—CYPRINUS MORALA, Buch.

Op. Cit. Pl. 18, f. 91, P. 331. Hardw. Illust. Pl. fig.

The head is equal in length to the altitude of the body, and to a fourth of the entire length, including the caudal fin; the lips are pendulous, the hinder one fimbriated on the edge; the fin rays are,

D.13 : P.16 : V.9 : A.8 : C.19.

This fish was found by Buchanan in the fresh water ponds of Bengal, where it reaches the size of a small herring. All the preceding species were placed by Buchanan with his true Cyprins, forming the fourth division into which he separated the family, and this species, which is ranked with his seventh division, is also here placed with the Cirrhins, from its general accordance with them in form; but there is one peculiarity which it possesses in common with the two following species, and which has been overlooked in both figures that have been published, namely, the transverse tendency of the colours descending in the form of faint bars from the back across the sides, very beautifully shewn in Buchanan's original drawing, though not mentioned in his description. This, together with their having a black spot at the end of the tail, induced me to describe the three species in question under a separate division in the outline of the family, for until we are acquainted with their habits, and the structure of their stomach and intestines, we have no means of deciding as to the genus to which they may belong.

VIII.—CYPRINUS DERO, Buch.

Op. Cit. P. 22, f. 78, P. 278.

Cyp. dhenro, id. Coll. *Dhengro* of the fishermen.

This species seldom exceeds four inches in length; its markings are similar to those of the last; it has only two cirri, and the fin rays are,

D.13 : P.18 : ? V.9 : A.7 : C.19.

Buchanan observes that the colours of the back and belly are regularly indented into each other on the sides, there is also a dark spot at the end of the tail. The snout projects a little in front of the mouth, is thick and perforated with mucous pores, or what Buchanan names, callous points. In the *Gang. Fishes* this species is placed with the Bangons or Gudgeons, to which perhaps it belongs.

IX.—CYPRINUS JOALIUS, Buch.

Op. Cit. p. 316.

Cyp. jayali, id. Coll.

This species has four cirri, with a dark spot at the end of the tail, and a similar distribution of obscure bars on the sides with the two preceding species, though it is placed by Buchanan in his fifth division. It grows to about three inches in length, and is common in the ponds and ditches in the north-eastern parts of Bengal; it is a brownish green colour above, and silvery beneath, the two colours uniting alternately in bars on the sides. The fin rays are,

D.11: P—? V.9: A.8: C—

The form of the mouth appears to be nearly the same as in the two last described.

SUB-GEN.—LABEO.

The Labeos agree in structure and habits with the Cirrhins, but have no cirri.

I.—CYPRINUS CURCHIUS, Buch.

t. 40, f. 3.

Kurchi of the Bengal fishermen, and *Courie* of the Assamese.

This species differs from *C. gonius*, Buch. in being destitute of cirri, and in having somewhat smaller pectorals; its length, exclusive of the caudal,

is rather more than thrice the altitude; the scales are very small, and extend in rows along the sides, seventy-eight in each row, and thirty in an oblique row from the base of the ventrals to the dorsum; the head is less compressed than the body. The fin rays are,

D.16 or 17 : P.15 : V.9 : A.7 : C.19.

The lips are continuous round the mouth, double and fimbriated on their margins, and formed for collecting a loose soft food of a confervoid kind, which occurs abundantly in most of the waters of the plains of India, and the remains of which is plentifully found in the intestines.

The stomach is a long tapering tube, which terminates gradually in an extremely lengthy but narrow canal, which instead of being disposed in circular or serpentine convolutions, appears coiled in complicated meshes which occupy more or less of the abdominal cavity, according to the state of ingesta at the time the specimen is examined. The waters in which this species appears to delight, are the larger rivers where the currents are sluggish, and the banks formed of sand or mud; or extensive jeels, such as those on the north-eastern side of Bengal. It seldom attains a greater size than a foot in length, is excessively bony, and rather insipid as an article of food.

The variety of this species described by Buchanan under the name of *Cyp. cursa* is distinguished by four cirri, and eight rays in the anal fin. The following are the characters of one which is common in Calcutta—seventy-eight scales along the lateral line, thirty-eight in an oblique row from the base of the ventrals to the dorsum; under lobe of the caudal smaller than the upper; no cirri; intestines and stomach thirteen lengths of the entire animal. The fin rays are,

D.17 : P.16 : V.9 : A.7 : C. $\frac{10}{9}$.

Plate 59, figs. 1, 2, represent the structure and disposition of the scales. Were I sure that my collection is complete in the varieties described

by Buchanan, I would add further figures of the structure of scales in this part of the family; but having some doubts on the subject, I must allow this group as well as the Cirrhins and Barbels, to stand for the present with some obscurity as to the number of species that belong to them.

II.—CYPRINUS CURSIS, Buch.

t. 38, f. 3.

Buchanan observes that it inhabits fresh water rivers and ponds in the south of Bengal, and is often found from two to three feet in length; it is full of bones, and many of the natives abstain from its use, imagining that if eaten on the same day with milk it will occasion a disease called elephantiasis.

The figure above referred to is taken from a dry specimen, and was lithographed before I was aware of the existence of an excellent figure in Buchanan's collection, which I consider to be a male individual of *Cyprinus curchius*, though he has given it one ray less in the dorsal and one more in each of the pectorals, yet I have examined so many specimens that I cannot but regard both as belonging to the same species.

Its length, exclusive of the caudal, is rather more than thrice the altitude of the highest part of the body. There are eighty-three scales on the lateral line, and twenty-seven in an oblique row from the base of the ventrals to the dorsum. The dorsal fin is placed on the middle of the back, equidistant from the snout and the caudal. The head is less compressed than the body, the eyes are placed high, and the crown is flatly arched from side to side; the lips are fimbriated and continuous round the mouth, and formed for collecting loose floating plants, such as are abundant in jeels and creeks; the snout is also furnished with two small cirri, too minute to be of much evident utility. The gill covers are full and gracefully rounded behind; the caudal and dorsal fins are large, the others less fully developed. The fin rays are according to Buchanan, D.15:P.18:V.9:A.7:C.19—or, as I have found them,

$$D.16:P.17:V.9:A.7:C.\frac{10}{9}.$$

The stomach is a small tapering tube terminating gradually in an extremely lengthy canal, and instead of encircling the abdomen, the whole is twisted spirally round the stomach. The contents of the canal is a green soft vegetable substance like chopped cabbage.

Its usual size is from twelve to four inches long; the colour is green above and silvery below. It is a beautiful fish, common in Bengal and Assam as high as Sudyah, but being full of bones is little valued as an article of food. If it be less useful in this respect than other Cirrhins, it is more serviceable than we are aware of, in common with the numerous Gudgeons, in clearing the indolent waters of the plains from a redundancy of vegetation with which they would be otherwise choked up.

I am not sure that these small scaled species might not be formed into a sub-genus with the Tench.

III.—CYPRINUS DYOCHEILUS, J. M.

P. 37, f. 1. *Goreah* of the Assamese.

It is without cirri, but the under jaw is identical with that of the Cirrhins, while the snout and maxillary are covered with thick muscular cushions. It is found in the clear active currents of the Bramaputra from Middle Assam to the rapids at the extremity of the valley, but appears to be equally unknown in mountain torrents, and sluggish rivers and jeels in the plains. The head is elongated, and covered with thick integuments which envelope the operculum and branchial rays; the eyes are small, and placed almost in the posterior third of the head; the depth of the body is equal to about a third of the length; forty-four scales are placed along the lateral line, and thirteen in an oblique line from the base of the ventrals to the dorsum. The dorsal fin is placed midway between the plane of the head, and that of the anal, and all the fins but the dorsal are largely developed, and indicate considerable powers of motion. The fin rays are,

D.12 : P.18 : V.9 : A.8 : C.19.

The colours are bluish or brownish black above and on the extremities of the fins, but bluish white along the belly ; the sides are also bluish-white with various stains of red and yellow on the shoulders.

On a closer examination of its structure, the limbs of the lower jaw are found to have a stronger ligamentous attachment in front than was observed in the true Cirrhins, while the articulation behind to the pteropalatine bones is considerably weaker, and the maxillary apparatus forming the front of the upper jaw is remarkably strong, the intermaxillary having firm articulations laterally with the outer sides of the apophyses of the limbs of the lower jaw, proving clearly that whatever power such a structure is intended to exercise, must be rather adapted to the crushing of detached objects, than the separation of such as are fixed or rooted to the ground, which would require a strong abutment of the jaw behind, as in the Gonorrhynchs. Hence we may infer, that the bruising of shells and seeds is the peculiar object of its existence. In its search for such food, it would naturally be led to shallow waters on banks of sand and boulders where shell fish and drifted fragments of plants are most common, and the dangers to which it is exposed in such situations from birds and other animals, as well as of being left above the retiring currents, would be more to be guarded against than in species inhabiting deeper waters ; hence those fins on which the velocity of its movements depend are large ; and like all those species that inhabit rapid currents, its snout is perforated by numerous pores, from which an abundant slimy secretion is carried backward over the body by means of its motion through the water, the friction or resistance of which is thus diminished ; this use of the mucous from the nasal pores of fishes I derive from Mr. Yarrell. The still more copious mucous secretion enveloping the bodies of Loaches and other *Apalopterinae* we may presume is given them as a means of escape from enemies, rather than to facilitate their movements in the water, as they are not expert swimmers. Nothing can better illustrate this, than that in Gudgeons destined chiefly to inhabit stagnant waters, and not formed for very rapid swim-

ming, the scales are remarkably rough. With all its dexterity and rapid swimming this species is more exposed to the nets of the fishermen than most other fish, and its native name is said by the fishermen to be derived from the instinct and agility it displays in attempts to elude them. According to the observations of Mr. Griffith, it is found in Upper Assam in the early part of the cold season, generally keeping near the surface in deep water at the foot of rapids; in such situations it declines all sorts of bait and flies, but is a highly esteemed article of food. In the lower parts of the river, where I saw it in Middle Assam about the end of February, its flesh was considered coarse, and its haunts were then in shallow waters, perhaps for the purpose of spawning, which may account for the slight discrepancies regarding its qualities and habits.

Its usual size is from one to two and a half feet in length, and though sometimes coarse, its flesh is always well flavoured.

II.—GEN. BARBUS.

Lower jaw composed of two lengthened limbs united in front so as to form a smooth narrow apex; the dorsal fin is preceded by a strong spinous ray; lips hard, four cirri, intermaxillaries protractile.

They seem to live less exclusively on a vegetable regimen than most of the Cirrhins, from which group they also differ in the form or sculpture of the body, as well as in possessing a shorter intestinal canal. The dorsal which is small commences half way between the caudal and the snout, the ventrals are opposite to it. At the insertion of the anal the body contracts suddenly in depth, leaving an abrupt tail about half the depth of the body, approaching to what we see in the Lizards. The body is more slender, the fins smaller, but the rays of which they are composed are larger, and the colours perhaps brighter than in the Cirrhins. In the latter the head is thick, and the subor-

bitar plates are narrow and nearly of equal breadth; but in the Barbels the head is compressed, and the suborbital apparatus forms broad plates behind, and narrow ones below the eyes; and it is on this difference in the breadth of the suborbital and postorbital plates that the length of the head in Barbels depends. The lower jaw is equal in length with the upper, and is formed of two lengthy bones having each a large pterygoid plate for the insertion of proportionally large muscles for drawing the jaws together; the mouth is horizontal, and at the chin the limbs of the lower jaw are soldered firmly together, where they form a narrow but smooth symphysis. Fig. 6, t. 54, represents the left ramus of the lower jaw of *Barbus hexastichus*; c, side view showing the pterygoid plate, d under side; a, point of union with its fellow at the symphysis, b, articulating surface behind.

I.—B. HEXASTICHUS, J. M.

t. 39, f. 2.

Cyprinus tor, Buch. *Lobura* of the Assamese.

Head small, postorbital plates equal to half the space between the eyes and the maxillaries. The relative length of the head to the entire length is as two to seven; twenty-five scales are ranged along the lateral line, and six in an oblique line from the base of the ventrals to the dorsum. The fin rays are,

D.11 : P.17 : V.9 : A.8 : C.19.

The three first rays of the dorsal are closely united and bony, the fins are short, and with the exception of the pectorals the rays of which they are composed are strong and coarse. The colour of the back, bases of the caudal and dorsal are greenish grey, as well as the upper part of the head; the rest of the fish is reddish yellow, with the tips of the fins a more decided red.

I found this species in Assam, and Buchanan met with it in the large rivers on the western side of Bengal; but the species he has figured for it in

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his collection is *B. progeneius*. It seems to delight in the clear brisk currents of large rivers, passing during the dry season into shallow tributaries to deposit its spawn; I am not aware of its being found in the jeels and muddy rivers of Bengal. Buchanan mentions it as growing to three or four feet in length; those I saw in Assam varied from twenty inches to two and a half feet. As an article of food it equals the *Ruee*, and might be extensively propagated, especially in low hilly districts where that fish would not answer so well.

II.—*B. PROGENEIUS*, J. M.

t. 56, f. 3.

Jungba of the Assamese.

Length of the head to that of the body as one to three; scales large and rounded posteriorly; twenty six along each lateral line, and six from the base of each ventral to the dorsum. Fins short. The number of rays are,

D.12: P.16: V.9: A.7: C.19.

The head is long and much compressed, the mouth is narrow and small, and from the lower lip a fleshy appendix is extended, by which it is distinguished from the neighbouring species; nevertheless it is figured in Buchanan's collection of drawings as *Cyp. tor*, to which it bears so close an affinity that he may probably have considered it to be the same. The intestines are capacious, and consist of four convolutions extending along the posterior half of the abdominal cavity, leaving the anterior portion of that cavity chiefly to the stomach and liver. The first is a conical sac (larger than the stomach of the *Cirrhins*) occupying the right side, and terminating simply in the intestine. The liver is broad consisting of several lobes, chiefly placed on the left side of the stomach.

III.—B. MACROCEPHALUS, J. M.

t. 55, f. 2.

Burapetea of the Assamese.

Length of the head compared to that of the body as two to five, twenty-seven scales along the lateral line, and six in an oblique row from the base of the ventrals to the back ; fins short, and formed of strong rays as follows,

D.11: P.16: V.10: A.7: C.19.

The postorbital plates are broadly expanded ; the eyes are placed in the anterior third of the head, equidistant between the preoperculum and the intermaxillary bones. The mouth is large and protractile, the lips smooth and round, the jaws and intermaxillaries strong and covered, as well as the interior of the mouth, with an uninterrupted extension of the outer skin.

The stomach and intestine are a simple continuation of a single canal consisting only of two convolutions ; the liver is large, and envelopes the stomach and intestines with its broad and elongated lobes.

Mr. Griffith caught many with live bait, some as weighty as 20 and even 30 pounds : smaller individuals are however taken with flies, and he remarked of this and another fish very nearly allied to it, called by the natives *Mahaseer*, that they are so extremely voracious and carnivorous in their habits as to swallow any of the smaller fishes that approach them. This is exactly what might be expected in one of the most typical species of a sub-typical group, for although the Barbels belong to the *Pæonominæ*, or herbivorous sub-family, yet as a natural group, it should according to the law of symbolical representation have its carnivorous forms, and from the prevalence of these among the Barbels I have made this genus the sub-typical, or destructive group of the *Pæonominæ*.

The only individual I have had an opportunity of examining was caught in deep clear water at the commencement of the rapids, and was three and a

half feet in length. They are in great request in the market at Suddyah, being a fine wholesome food. They might be propagated in hill streams, but their voracity would be a decided objection to their introduction to fish ponds.

IV.—B. HEXAGONOLEPUS, J. M.

Pl. 41, f. 3.

Bokar of the Assamese.

Length of the head to that of the body is as one to four; twenty-seven scales along the lateral line, and seven in an oblique line from the base of the ventrals to the ridge of the back. On the anterior part of the body the exposed surfaces of the scales represent hexagonal outlines, the fins are placed as in the preceding species, but the rays of the ventrals as well as those of the pectorals are small. The fin rays are,

D.12: P.16: V.9: A.7: C. $\frac{10}{5}$.

The head is small and little compressed, the snout smooth and slightly rounded, and the postorbital plates less expanded in this than in any of the other species, having a smooth dorsal spine and large scales. In large sized individuals the back and head, base of the fins and scales are blackish grey; but the opercular plates, scales, and fins are tipped with yellow. In young ones a leaden hue supplies the place of yellow, and the fins are tipped with black.

The stomach is about the length of the body, gradually contracting till it joins the intestines, which are thrice the length of the stomach, but of great capacity, expanding in size from their commencement, to about the middle of their length, and again gradually contracting until they reach the vent. In the stomach and intestines I found numerous minute bones of small fishes. Instead of the intestines of this species being disposed in transverse or longitudinal folds, they are convoluted transversely. Mr. Griffith remarks that the *Bokar* is to be found in all large rivers on the eastern frontier, from the base of the mountains to the situation at which the currents first become languid

in the plains, keeping mostly in the middle of the stream, where it takes a red hackle very freely, as well as worms and other bait. It is very powerful, often attaining two feet and upwards in length, and usually weighing from eight to twelve pounds.

There is still another large species *Cyp. pitutora*, Buch. closely allied to the preceding Barbels, which according to Buchanan sometimes attains nine feet in length;* it has the following rays in its fins,

D.11 : P.15 : V.9 : A.7 : C.19.

The head is said to be blunt, oval, and small, with a protractile mouth, and the scales to terminate with a notch behind. The first of these characters would seem partly to refer it to *B. hexagonolepus*, while the notch at the apex of the scales is only apparent in *B. macrocephalus*. There is no drawing in Buchanan's collection of the species alluded to, and as his description is not sufficiently clear, we must for the present consider *Cyp. pitutora* as a doubtful species.

V.—B. MEGALEPIS, J. M.

Cyp. mosal, Buch.

Hardw. Illust. Tab. 93, f. 1.

The only specimen of this species I have seen is contained in a small collection of fishes presented to the Society by Mr. Hodgson. Its principal difference from the last described consists in its having a longer head, which is

* The proportional depth of such an individual could not be less than two feet. Mr. Yarrell alludes to a Carp, the largest he could find any record of, and which weighed twenty-two pounds; but it appears from a notice in the Phil. Mag. Aug. 1837, that a Carp twenty-three pounds weight had been found in England in 1771. There can be no doubt however that the Barbel alluded to by Buchanan must have been twice that weight at least, and that twenty-three pounds is an ordinary weight of many of the Indian species of this and the last described genus.

narrower and more compressed at the snout; but as the contents of the abdomen were removed from the only specimen examined, I have been unable to ascertain whether the digestive organs possess any peculiarities.

The head is equal to one-third of the body in length, twenty-six scales are ranged along the lateral line on either side, and six in each oblique row from the base of the ventrals to the dorsum. The fin rays are,

D.12 : P.15 : V.9 : A.7 : C. $\frac{10}{9}$. Or, according to Buchanan—

D.13 : P.17 : V.9 : A.8 : C.19.

The first four rays are said by Buchanan to be united in the dorsal, while I can only observe three to be thus joined, which may reconcile my twelve with his thirteen; and as the last ray of the anal is double, Buchanan may have reckoned eight where I have only seven.

The *Mosal* was found by Buchanan in the Kosi river, on the northern side of Bengal. Mr. Hodgson's specimen came, I presume, from the same quarter, where Buchanan observes it sometimes attains four or five feet in length, and that it is of a long, compressed, but thick form, more prominent above than below; its colours are shining green on the back, softening into silvery on the belly: the head, he says, is sharp, oval, and narrower than the body and smooth, with a small tubercle (not however a peculiar mark) between the nostrils which are near the eyes; the mouth is low and horizontal, with rounded and smooth lips; the lower jaw is rather shorter than the upper.

The Native names *Mahasaula*, *Mahaseer*, and *Tora*, variously corrupted, probably referring to the size of the scales or the head, are without discrimination applied by the Natives of Bengal and Assam to the preceding five species, the scales of which are so large that Buchanan informs us gaming cards are manufactured from them at Dacca. They appear to be confined to the rapid and clear currents of the larger rivers along the skirts of mountains, and are therefore only met with in the northern and eastern parts of Bengal, as well as Upper Assam. Their flesh is free from the numerous small bones that lessen the value of many otherwise important species, and afford an excellent,

wholesome, and nutritious food. These fishes are, however, peculiar to remote unpopulated districts where no attempts are made to cure them, they are consequently lost to the wants of other places where an unlimited demand for dried fish must prevail at all seasons, but particularly during the rains and hot weather, when fresh fish become scarce.

There can be no doubt that if some relaxation of salt duties could be made in favour of those who would embark in such a business, a profitable and useful trade might be established to a far greater extent than we can at present form any notion of. The season for fishing is short, and without the means of saving more than can be consumed when fresh, the fishermen have nothing to stimulate them to any exertion beyond that of earning during their brief season, a sufficient sum to support them during the rest of the year. Had the fisherman the means of preserving the results of his labor, his chief market would commence when the fishing season ends, and his industry would then become a permanent benefit to himself and to the country at large. Sea fisheries would be of still higher importance, although neither should be neglected.* The cold season, from November to February, is the time at which fishes are chiefly taken; the waters being then low the fish are confined to narrow channels, and are often completely cut off from the larger streams and left in pools, in which they are easily secured. When passing Solano Mookh with the Assam deputation in January, I saw boats laden with most of the five kinds of Barbels just described, from one to two and a half feet in length; but as Suddyah, the nearest market at which they could probably be disposed of, was thirty miles distant, and a strong current to be opposed in reaching

* The attention of the Royal Asiatic Society was directed to this subject in April last, by my friend Dr. Cantor, whose opportunities of making himself acquainted with the subject during the time he was employed with Capt. Lloyd in the *Sunderbunds*, should render his opinions of considerable weight. Since then the discovery of isinglass in a large *Polynemus*, which frequents the estuaries of the Ganges in shoals every cold season must, if thoroughly established, be the means of opening a new and inexhaustible branch of trade in a quarter where it was little expected.

that place, and no means of curing the fish, the owners entertained little hopes of realising any thing whatever by them.

VI.—*BARBUS CHEILYNOIDES*, J. M.

t. 57, f. 5.

Journ. As. Soc. Beng. 1838, t. 56, f. 5.

For this species we are indebted to Dr. Macleod, who found it in the mountain streams at Simla.

The length of the head to that of the body is as one to two and half, intermaxillaries protractile, lips round, smooth, and thick, with four cirri. The body contracts suddenly under the dorsal and over the insertion of the anal fin; there are thirty-three scales along the lateral line, and nine in an oblique row from the base of the ventrals to the dorsum. The fin rays are,

D.10 : P.16 : V.9 : A.7 : C.18.

The three first rays of the dorsal are united and spinous, the pectoral fins are small, and their rays slender in proportion to those of the ventrals.

The intestine and stomach are a small and continuous tube equal to about twice the entire length of the animal.

The thick lips and blunt profile of this species give it somewhat the appearance of *Cyp. chedra*, Buch.; its usual length appears from Macleod's specimens to be from four to six inches, but it may attain a larger size.

VII.—*CYP. SARANA*, Buch.

Op. Cit. p. 307. *Cyp. Kunta*, id. Coll. *Cyp. Kunomoo*, Russ.

The first two rays of the dorsal are spinous, the second finely serrated behind; the head is blunt, oval, small, and smooth, with a small bone at either side of the upper lip. The fin rays are,

D.10 : P.16 : V.9 : A.8 : C.19.

The colour is green above, below silvery ; scales large. Such are the only characters of value given of this species by Buchanan, who supposed it to be probably identical with *Cyp. kunamoo*, Russ., though the dorsal of that species contained only nine, and the anal only seven rays.

VIII.—B. SPILOPHOLUS, J. M.

Pl. 39. f. 4.

Cyp. chagunio, Buch.

Length of the head to that of the body is as one to three, head much compressed, eyes equidistant between the snout and the branchial aperture, suborbital plates narrow, cheeks and snout porous, the latter abrupt, depressed, and projecting in front of the mouth which is low, narrow, and horizontal; dorsal margin sharp in front of the fin; the third ray of the dorsal finely serrated behind, the last is double. The fin rays are,

D.11 : P.15 : V.9 : A.7 : C $\frac{10}{9}$

Forty-seven or forty-eight scales are placed along the lateral line, and sixteen or seventeen in an oblique line from the base of the ventrals to the dorsum, with a black diffuse spot at the base of each scale; colour blackish grey along the back, changing to bluish white below. The specimen from which the description and drawing were taken, was presented to the Society by Mr. Hodgson, and had the two last rays of the anal prolonged to extended filaments; the species is probably the same as the following, which like *C. sarana* is said to have large scales,* but if we compare the scales of

* The fin rays of *Cyprinus chagunio*, Buch. correspond with those of *Cyprinus pitulora*, id.; but in the former, the dorsal spine is serrated, and in the latter it is smoother behind; in the former there are but twenty-six scales along each lateral line, in the latter forty-eight. The Indian Barbels may be conveniently divided into two sections, namely—species with large scales and smooth dorsal spine, and species with smaller scales and serrated dorsal spine. This group as well as the Cirrhins requires to be made the subject of a distinct monograph.

B. spilopholis with those of most other Barbels we must consider them as small, though they are large compared with those of *B. progastus*. The whole of our Indian Barbels, as well as Cirrhins, will however require much further investigation and revision.

The scales of *Cyprinus chagunio*, Buch. are spotted at the base, and the head is compressed, with round tubercles distributed on its fore part. The fin rays are,

D.12 : P.17 : V.10 : A.8 : C.19.

Colours above green, below silvery. It was found by Buchanan in the Jumna and the northern rivers of Behar and Bengal, and is said to be an excellent food.

IX.—*B. DILICIOSUS*, J. M.

t. 39, f. 3.

General figure short, head blunt, mouth directed obliquely upwards, suborbital plates narrow, thirty-four scales along the lateral line, and eleven in an oblique line from the base of the ventrals to the back. Dorsal preceded by a spine finely serrated behind. Fin rays are,

D.12 : P.16 : V.9 : A.7 : C.19.

Colour bluish grey above, but bluish white beneath, with a diffuse golden stain on the operculum.

The stomach of this species extends the whole length of the abdominal cavity, and contracting slightly terminates in an intestine of moderate length, which is merely reflected once a short way back upon the stomach and thence is extended to the vent.

The ordinary length of the species is about ten inches. It is found in languid streams on sandy bottoms in Upper Assam, and is considered an article of luxury from its fine sweet flavour, wholesome qualities, and probably also from its comparative scarcity. It is one of those species that might be introduced with advantage, and propagated extensively in fish ponds in Upper India. It seems to approach very nearly to the *Perilamps*, as well from its

upturned mouth, its small size compared with the other Barbels, its shorter abdominal canal, and the bright spot or golden tinge on the operculum, while the absence of the tooth on the lower jaw, and of stripes or spots on the body, and the small anal, are characters which must place it with Barbels.

SUB-GEN.—OREINUS, J. M.

Mouth directed downwards, lower jaw shorter than the upper, snout muscular and projecting, furnished with cirri. Dorsal preceded by a serrated spinous ray. Scales small. Intestinal canal and stomach form a more or less capacious tube from five to six lengths of the body.

The only three species known are herbivorous; with one, *O. progastus*, I have been acquainted since my visit to Upper Assam, a second was brought down by Mr. Griffith in June last from Boutan, and a third still more recently by Dr. Macleod from Simla. It was not until I received this last, that I was fully impressed with the necessity of separating them from the true Barbels, not only on account of their herbivorous habits, but of their peculiar form, and the structure of their mouth, which altogether indicate a relation to the Gonorhynchs, while the intestinal canal and dorsal spine bring them closer to the Barbels, as a subordinate part of which genus we may still consider them.

I.—*O. PROGASTUS*, J. M.

Pl. 40. f. 4.

Adoce of the Assamese.

This species is easily known by its lengthened and fleshy snout, small mouth, and the suborbital bones forming a narrow band below and behind the eyes, dorsal fin anterior to the middle of the body, with a strong ensiform spine toothed behind; the abdomen is abruptly enlarged beneath the pectorals, by which character alone it is readily distinguished from all other species of the

family ; the scales are small, and the body much compressed. The fin rays are,
D.12 : P.13 : V.10 : A.7 : C.19.

The stomach is of considerable size ; and of a dark reddish brown colour ; the intestines are a simple continuation of the stomach, and are of moderate length, soft, dark coloured, and filled chiefly with a vegetable pulpy matter.

This species is said by the natives of Assam to occasion swimming of the head and temporary loss of reason for several days, without any particular derangement of the stomach ; the cause of which I shall endeavour to account for in noticing similar effects produced by some of the *Gonorhynchæ*. It is the most herbivorous of the *Barbels*, and like some of the *Gudgeons* tends rapidly to decay after death, and in the abdominal cavity a copious oily secretion is found which is probably the cause of its bad effects.

Mr. Griffith, who is better acquainted with the habits of this species than I am, remarks that it is chiefly found in rivers, along the borders of Assam, where the stream is rapid enough to prevent any kind of navigation with boats or canoes ; that it attains six or eight pounds weight ; and that the fishermen informed him if eaten it occasions all the symptoms of drunkenness, which coincides with what I had myself learnt regarding its effects.

II.—O. GUTTATUS, J. M.

Pl. 30. f. 1.

Labial filaments very minute, dorsal placed behind the middle, lower part of the second ray bony, and serrated behind, but soft and smooth at the top. Eyes and branchial apertures small, head covered with thick integuments, part of which form the branchial membrane and conceal its rays, body covered with very minute scales, lateral line extends straight along the sides which are marked irregularly with brownish spots, having a black elevated nucleus. The fin rays are,

D.10 : P.17 : V.11 : A.10 : C.20.

Colour brownish above, below silvery tinged with yellow.

We are indebted for our knowledge of this species to Mr. Griffith, who found it in the Monas, and other rivers in different parts of Boutan, between the elevation of two, and five thousand feet. It may occur higher, but Mr. Griffith remarks, that in vallies above five thousand feet though fine clear streams are common, yet fishes of any kind do not occur in them; and the natives assured the Mission to which he was attached, that no fish existed at such elevations.

The lower jaw is short and strong, composed of two deep bony limbs firmly soldered at the symphysis, and covered with a thick cartilaginous integument, similar to that which forms the same part in *Gonorhynchus petrophilus*; it is probably used as in that species for scraping confervoid plants from the surface of the rocks. The intestines are more capacious, but not quite so long as in the *Gonorhynchus*. Mr. Griffith remarks that though this species delights in rising above the surface yet it will not take flies.

III.—O. MACULATUS, J.M.

Length of the head to that of the body as one to three and half, snout thick and muscular, and by its action the mouth, which is situated inferiorly, is opened and closed as in the genus *Gonorhynchus*.

There are four small cirri, and the lips are thick, hard, and smooth. Body above dark and irregularly spotted, the three first rays of the dorsal are spinous, scales very minute, suborbital bones concealed beneath a thick covering of integument. The fin rays are,

D.11 : P.18 : V.10 : A.5 : C.19.

Intestinal canal capacious, about four lengths of the body, and found to contain a copious green vegetable matter. *Habitat.* Mountain streams at Simla; ordinary length about six inches.

To these species must be added *Cyprinus Richardsonii*, Gray. Hardw. Illustrat. t. 94, f. 2, if it be distinct.

III.—GEN. CYPRINUS PROPRIUS.

Body elevated, lower jaw short and rounded in front, lips hard, thick, and without cirri; dorsal long.

I.—C. SEMIPLLOTUS, J. M.

Sundaree and *Sentoree* of the Assamese and Singphos.

Pl. 36, fig. 1.

The head is small and fleshy, depressed at the snout, which is thick and square, with a row of nine large pores extending horizontally round the nose.

The body is compressed and deep, the upper and lower margins unequally arched, the dorsal is long, and preceded by a spine. The fin rays are,

D.27 : P.16 : V.9 : A.9 : C.19.

The colours along the back are greyish black, changing to bluish white along the sides. There are thirty-two scales along the lateral line, and ten in an oblique row from the base of the ventrals to the dorsal.

Mr. Griffith remarks, that the ordinary weight of this species varies from $1\frac{1}{2}$ to $2\frac{1}{2}$ pounds, and that it is usually found near rapids; the larger ones in the deeper waters, where they are seen, particularly of an evening, rising to the surface, but they refuse all sorts of flies and baits, although if a stone be cast into the water, all these fishes in the vicinity assemble round the spot. The *Dhoms* (fishermen) take them by a casting net, observing great silence, and frequently first dropping a stone to assemble the fish in the spot on which it is intended to cast the net.

Structure.—The opercular plates and bones of the head are concealed beneath a thick skin, or integument. The intermaxillary is fixed to the maxillary bones, and these last to the nasal and suborbital plates; so as to

admit of no independent motion in the upper jaw, as in the European Carp, and most of our Indian Barbels. The pre-operculum is short, and forms, in conjunction with the anterior extremity of the inter-operculum, a convex articulating surface for the respective branch of the lower jaw, which proceeds almost transversely to meet that of the opposite side, giving the profile a shortened character. The sub-operculum is very small, as well as the branchial rays, which in this, as well as in *Catastomus dyocheilus*, and some of our Indian Gudgeons, and most of the *Gonorhynchi*, can only be seen on removing the integuments.

The stomach is a simple but lengthened sac, terminating in a very long narrow intestine; the abdomen contains an abundant supply of soft fat, in which the intestines seem to float.

This species, which is reckoned the most delicious in Assam, is found only in the upper parts of the province, where the currents become clear, and somewhat rapid. It is common at Suddyah, and is said to be found from thence to the foot of the mountains. Its usual size is from twelve to twenty inches in length, and from four to seven inches deep from below the pectorals to the shoulders. It contains few bones, and is rich, fine flavoured, and wholesome, and for these reasons always sells at a higher price than ordinary fishes. It is one which might be introduced with great advantage to hilly countries, especially to places in India selected as *sanataria*, where its superior qualities would soon render it a favourite dish, and the place perhaps a favourite resort to others as well as invalids.

The most suitable *vivarium* for this species might be formed by stopping up a clear mountain stream to a certain depth, and filling the irregularities of the bottom with sand, gravel, and stones; there should be a current in the water, and to prevent the escape of the fish, a grating should be fixed below; and at the opposite end a stronger grating, if necessary, to prevent the introduction of rubbish during floods, as well as the escape of the fish, should the fall not be sufficient for the latter purpose. *Barbus deliciosus* is another

species for which the same fish-pond would answer, and which it would be equally desirable and practicable to introduce to similar situations.

II.—C. CATLA, Buch.

Pisc. Gang. Pl. 13, f. 81—p. 287. *Catla* of the fishermen.

Buchanan says that this species differs from *C. carpio*, or common Carp of Europe only in wanting cirri, but it also differs from that species in the want of spinous rays in the dorsal and anal, as well as in general form. It approaches however much nearer to the Prussian Carp (*C. gibelio*) the general figure, character of the fins, and number of their rays, being the same in both; but they differ in the size of their scales and proportion of the head.

The length of the head is half that of the body (exclusive of the head and caudal), and its depth is equal to half its length. There are forty-four scales along the lateral line, and fourteen in an oblique line from the base of the ventrals to the back, the length of the dorsal is equal to about a third length of the body. The fin rays are,

D.18 : P.18 : V.9 : A.8 : C.19.

The lower jaw consists of two broad bony plates joined slightly in front, where they project a little before the upper jaw.

The *Catla* is said by Buchanan to be limited to Bengal, I found it however as high in the Bramaputra as Bishenath, although it is there less abundant than within the limit of the tides beyond the reach of brackish water; but it lives and attains great size in tanks and ponds quite unconnected with tides and currents, so that it is capable of being introduced wherever there is fresh water. There is no species of more importance than this in an economical point of view. Buchanan informs us that it is sometimes found four feet in length, and that it is a light wholesome food; the head, he remarks, is peculiarly delicious; this I can also answer for, and am only at a loss to know why it should have been so long overlooked by our epicures. Although

the *Catla* is one of the commonest fish in Bengal, Buchanan remarks that it is unknown in most parts of Behar. If a little attention were directed to the extirpation of Alligators, and other destructive animals in our tanks, there is no limit to the extent to which this, and similar useful species might be propagated.

IV.—GEN. GOBIO.

The Gudgeons, according to Cuvier, have both the dorsal and anal short, and are without spinous rays in any of the fins, or cirri to the mouth. As, however, we have some Indian species with two cirri, it is necessary to omit the consideration of those appendages in the characters of the genus, otherwise well marked by the lower jaw being shorter than the upper, without having the mouth directed downwards, as in the Gonorhynchs. The vent is placed close in front of the anal fin, and not between the ventrals, as in the Gonorhynchs; and in many of the species the liver is either altogether wanting, or dispersed in numerous small glands throughout the folds of the intestines. I have already remarked that cirri are very uncertain characters in this family, and that even among the Cirrhins themselves, a genus characterised by these appendages, it is often difficult to say whether they are present or not; and in the closely allied group *Labeo*, cirri are altogether wanting, though, if we may judge from what appear to be Indian species of *Labeo*, their habits and structure in other respects hardly differ from the Cirrhins. The Gudgeons as I have limited the group, are strictly herbivorous, and surpass all other fishes of the family in the length of the alimentary canal, which is from eight to eleven lengths of the body, inclusive of the head and caudal fin, and is always filled with a soft green pulpy aliment. The stomach is a long tapering tube, and differs only from the rest of the canal in the longitudinal direction of its muscular fibres; the lower jaw is composed of two bones soldered together at the symphysis; the lips are hard, with a slight ridge on the upper surface of the lower one in many of the species, a

character by which Buchanan distinguished the group under the native name *Bangon*, but the ridge in question, though commonly met with, is not universal, or peculiar to the group, as it is also observed in the genus *Mugil*, and besides, is very obscure.

The forms which come under this genus resolve themselves into three divisions—1st, such as have two minute cirri; 2d, those with a hard, round, and smooth snout without cirri; 3d, species with a rough, soft, and fleshy snout.

In the first of these divisions we have, 1. *Cyprinus mrigala*; 2. *Cyprinus curmuca*; 3. *Cyprinus reba*; 4. *Cyprinus angra*.

In the second division we have, 1. *G. lissorhynchus*; 2. *G. isurus*; 3. *G. limnophilus*; 4. *G. bicolor*; and 5. *G. anisurus*.*

In the third division, 1. *G. ricnorhynchus*†; 2. *Cyprinus boga*; 3. *Cyprinus pangusia*; in all, eleven, which I have been enabled either to identify with Buchanan's species, or describe as distinct.

I.—CYPRINUS MRIGALA, Buch.

t. 88, f. 1 — P. G. t. 6, f. 79.

This is one of the most important of our Indian species, and was justly associated by Buchanan with his Bangons, though afterwards erroneously referred in the *Règne Animal* to the Cirrhins. It is the *Mrigala* of Sanscrit writers, and the *Mirga*, *Meerica*, &c. of the Bengal and Assam fishermen. The figure given of it by Buchanan is not well expressed, the head is too much flattened or depressed, the scales are represented too large, and there are other disproportions which to one well acquainted with the fish, give his figure an unnatural appearance, for which reason I have given another figure which has been care-

* These species are probably equivalent to *Cyprinus cura*, Buch. *Cyp. bata*, id. and *Cyp. acra*, id. I have however, been unable to reconcile them with Buchanan's descriptions.

† *Gob. ricnorhynchus*, J. M. is equivalent to *Cyp. falcata*, Gray Hard. Illust. t. — f. —; *Cyp. boga*, Buch. *Cyp. pangusia*, id. and *Gob. malacostomus* of my synopsis are probably but one species.

fully taken from life. The altitude of the deepest part of the body is contained four and a half times in the entire length, and the head and caudal are each equal in length to the depth of the body. There are forty-four scales along the lateral line, and fourteen in an oblique row from the base of the ventrals to the dorsum. The dorsal fin is placed somewhat nearer to the nape than to the base of the caudal fin, and the length of its base is equal to the depth of the body; the ventrals are placed opposite the dorsal, and the space between the anal and caudal is equal to half that between the former and the ventrals. The fin rays are,

D.16: P.17: V.9: A.7: C.19.

The eyes are placed almost in the anterior third of the head. Buchanan states that the pupils are circular, but I have found them oval, with the long diameter vertical. In the variety called *Rewah*, however, the pupils of those I have examined are circular, and if we could rely on such peculiarities as constant, they would afford an excellent character by which we might distinguish the species in very difficult cases.

The mouth is placed at the end of the head, having two small cirri placed anteriorly on the upper lip. The under jaw is formed of a very slender rim composed of two bones meeting in the middle at the chin, where they are soldered firmly together.

The outer extremities of these *ossa siagona*,* as they may be named for convenience, are articulated above to the corresponding extremities of the intermaxillaries, and behind to the anterior extremities of what Cuvier named in the Perch, the *angular bone*. It has already been shown that the angular bones really form the lower jaw both in the Cirrhins and in the Barbels, with this difference, that in the one case they are united, and in the other unattached by a bony union in front. In the Gudgeons, however, and in this species in particular, the angular bones are nearly parallel to each other,

* From Σιαγον, the jaw bone.

so that the front of the lower jaw is composed of the two transverse limbs *a*, *e*, *c*—Pl. 54, f. 2, above described: *a*, is the point of union with its fellow at the symphysis; *b*, the articulating surface behind; *d*, the body of the angular bone corresponding with the analagous bone in the Perch, and with f. 4, 5, 20, and 21, Pl. 54, in the Cirrhins.

The intestinal canal was found to be sixteen feet in length in an individual whose entire length was two feet, and loaded with a transparent viscid fluid, as well as a grey pulpaceous substance. The coats of the intestines are marked at short intervals by opaque muscular rings. The stomach is merely distinguishable from the intestines by the longitudinal direction of its fibres, and seemed to be without either cardiac or pyloric valves. The anterior extremity of the stomach in an individual of the dimensions already mentioned, was large enough to admit the finger, while the posterior extremity was about the size of a large goose quill. The liver is large, and consists of elongated lobes of dark red colour, extending along each side of the stomach. The air vessel consists chiefly of a great anterior cell of an almost cylindric shape, with rounded extremities; this is separated by means of a stricture from a balloon-shaped posterior cell of considerably smaller capacity.

I have entered thus fully into a description of this species, because it is not only one of our most valuable fishes, but in a scientific point of view, is to be regarded as the most perfect member of the group to which it belongs. Its superiority in the one respect being fully established by its bulk, and the frequency with which it is met with in the bazars as well as on our tables; and in the other, by the variety of its food, which consists, as well as I could determine from the contents of the stomach, of soft shell fish and vegetable matter, a diversity of aliment which requires a higher degree of intelligence to select, and a more perfect organization to procure and digest, than can be supposed to belong to the ordinary species, which appear to subsist exclusively on *confervæ*, and other plants that abound in the waters of ponds and swamps, where the Gudgeons of this country are chiefly found.

The *Mrigala* is most esteemed during the rainy season in Bengal, by Europeans at least; the usual size at which it is taken is from eighteen inches to two feet in length, when smaller the flesh is bony, and when larger it becomes coarse, and loses flavour. Its form is seemly, and the colours extremely rich, but undefined, generally consisting of dark green along the back, but sometimes brown, or both intermixed, with a gold-yellow iridescence on the sides: it is one of those species which might be propagated with advantage wherever a sufficiency of fresh water occurs. The *Rewah* I consider to be nothing more than the young *Mrigala*; I have not however found it any where but at Calcutta, and there are some interesting differences both in the disposition of the intestines, and the form of the air vessel in the two kinds, which deserve to be pointed out whether we regard those differences as constituting distinct species, or as elucidating the progressive stages of development in the same individual. In the *Mrigala* the anterior cell of the air vessel is large, constituting almost nine-tenths of the organ; in the *Rewah* the posterior cell is larger than the anterior. In the *Mrigala* the intestines are convoluted in longitudinal folds; in the *Rewah* the folds of the intestine are disposed obliquely across the abdomen, but the proportionate length of the alimentary canal to the size of the body is the same in both. The scales in both are of the same form, but the structure is somewhat different.

II.—CYPRINUS CURMUCA, Buch.

Journ. Mysore, V.11, t.30.

This species is placed by Buchanan amongst his true *Cyprinus*, but from his figure, as well as his description, I am inclined to consider it as belonging to this place, although he says the jaws are protractile, a character which is not common in the Gudgeons, and which will require to be particularly inquired into hereafter. I am aware that to describe two different species under one name, is more calculated to create confusion than giving a new name to a species

described before ; at all events, the latter error is one that may be more easily corrected than the former. I have, however, a specimen in my collection which corresponds so closely with Buchanan's description, that I might almost venture to look upon it as the same. But in hopes that some member of the Society will forward to our Museum a specimen of the *Curmuca*, which is common in the rivers of southern India, I will withhold for the present any further notice of this species than may be found in the synopsis.

III.—CYPRINUS REBA, Buch.

Had Buchanan not stated that the cirri of this species are appended from the end of the snout, instead of the corners of the mouth, I should have been disposed to refer the specimen which is alluded to above, to this species, which is common, he observes, in the north-western parts of Bengal, where it attains two feet in length : as I have not seen it, I must refer the reader to Buchanan's description.

IV.—CYPRINUS ANGRA, Buch.

Hardwicke's Illust. t. 86, f. 1. Pisces l. c. t. 3, f. 1.

I had figured and named this species *Gobio leprosus* during my journey in Assam, before I became acquainted either with the figure in Hardwicke, or aware of the existence of Buchanan's unpublished drawings ; but I have since lost the specimen I had collected on the occasion, and must now trust to my original notes for a description of it. The length of the head to that of the body is as one to four ; operculum rounded behind ; mouth small, directed obliquely upwards ; snout prominent and fleshy, with two small cirri at the corners of the mouth ; suborbital plates broader below than behind the eyes ; pectorals small, with their bases slightly covered by the branchial plates. The fin rays are,

D.10: P.10: V.9: A.8: C.19.

There are thirty-five scales along the lateral line, and fourteen in an oblique row from the base of the ventrals to the dorsum. Colour pale olive brown above, and reddish-white below. Intestines long, dark coloured, and convoluted in circles round the parieties of the abdomen. Posterior cell of the air vessel much larger than the anterior.

It was found by Buchanan in the Bramaputra, and there it also occurred to me. The only part of the figure in Hardwicke to be relied on is the outline, and even that is so obscured with a fanciful display of colours that no one, unless familiar with the species, could detect its resemblance to the drawing.*

V.—GOBIO LISSORHYNCHUS, J. M.

t. 55, f. 5.

This species includes those varieties, as far as I am able to make them out, referred to in the *Gangetic Fishes* under the names of *Cyprinus cura*, *Cyprinus acra*, and *Cyprinus bata*, and which are distinguished by hard smooth lips, snout without cirri, and with from eleven to twelve rays in the dorsal fin. In the preceding part of this paper, in which I have given an outline of the species and groups composing the family generally, I have been anxious to keep distinct all species which we have any good authority for supposing really to exist in India, in hopes that further information will be obtained regarding them.

Buchanan distinguished *Cyprinus bata* chiefly by the upper lobe of the caudal fin, which he says is longer than the lower; but in the drawing he has left us,

* During the twenty years Buchanan's drawings lay at the Botanic Garden before they were transferred to Hardwicke's Illustrations, many of the colours appear to have undergone a change, such as light blues and greens becoming dark brown; not aware of this, the copyist has not only imitated the altered colours, but added a little to their intensity; the consequence of which is, that both this and the other figures similarly obtained in the expensive work referred to, are made to appear in black, where they should only be pale grey or green.

there is scarcely any perceptible difference between the lobes of the caudal, otherwise we might suppose my *G. anisurus* to be his *Cyprinus bata*; but it is to be remarked that in my species the lower, and not the upper lobe is the longer of the two. *Cyprinus acra*, Buch. is also said to have the upper lobe of the caudal longer than the lower, but it has only eleven rays in the fin of the back; now, whether a species can be said to have eleven or twelve rays in the dorsal, depends entirely on the degree to which the last ray is separated or divided, which in this group it always is, more or less; there can therefore be little doubt that *Cyprinus bata* and *Cyprinus acra* are the same species. *Cyprinus cura*, Buch. is said to differ from each of the former two in the lobes of the caudal being equal, and by there being only seven rays in the anal, while each of the other fins has eight; but what has been said with regard to the division of the last ray of the dorsal, applies also to that of the anal fin, which also in this group is always divided; and according to the degree in which it is separated, the fin may be said to have one ray more or less. I therefore treat these three varieties as one species, which I have named *G. lissorhynchus*. Before entering on the description of this species, I must be allowed to mention one peculiarity which it possesses in common with *G. isurus* and *G. limnophilus*, namely, that there is a slight prominence on the symphysis of the lower, and a corresponding fissure in the intermaxillaries of the upper jaw, but the lower jaw is always round in front, and shorter than the upper, which prevents the character just noted from being confounded with an analogous prominence on the apex of the lower jaw in *Sarcoborinæ*, in which sub-family that organ is always narrow and pointed at the apex.

The head is compressed, and equal to about a third of the length of the body, exclusive of the head and caudal fin; the snout is hard, deep, prominent, and smooth, without cirri. The eyes are placed anterior to the middle of the head; the posterior margin of the operculum is broad and somewhat square, or, unequally rounded. The body is symmetrical, equally arched above and

below ; dorsal and ventrals are opposite. The lobes of the caudal are equal in length. The fin rays are,

D.11 or 12: P.16: V.9: A.7 or 8: C.19.

There are thirty-nine scales along the lateral line, and thirteen from the base of the ventrals to the dorsum.

The liver is situated in the anterior part of the abdomen, immediately behind the diaphragm as usual, in conjunction with the stomach ; the alimentary canal and stomach form a long and narrow tube, equal to eight or nine lengths of the body. The usual size which this species attains is from four to twelve inches in length, it is found in all the fresh waters throughout Bengal and Assam.

VI.—GOBIO ISURUS,* J. M.

This species bears so striking a resemblance to the figure Buchanan has given of *Cyprinus ariza*, that I have thought it unnecessary to attempt a better representation of it, although there is no reason to suppose it to be the *Cyprinus ariza* which Buchanan has described ; on the contrary, it appears to me to be quite distinct from that species, in which the snout is rough, soft, and perforated by numerous mucous pores, while in this it is smooth, hard, and without pores. It corresponds with *G. limnophilus* in the number of its scales, but in that species there is a distinct tube passing along the middle of every scale on the body, as well as on that row which forms the lateral line, and to which such tubulated scales are usually confined ; so that *Gobio limnophilus* has as many lateral lines as there are rows of scales on the sides, while in this species the tubulated scales are confined to the lateral line alone.

The length of the head is equal to two-thirds of the depth of the body, and a fourth of its length ; the scales are large, and disposed in rows, of which there

* See Buchanan's figure of *Cyprinus ariza*, Journ. Mysore, vol. iii. t. 31.

are fourteen between the ventrals and dorsum on either side, and thirty-seven disposed along the lateral line. The fin rays are,

$$D.11 : P.14 : V.9 : A.7 : C.\frac{10}{9}.$$

The colour above is bluish grey, diminishing in intensity on the sides; the scales are long, and soft, presenting on the upper parts of the body pentagonal exposed faces.

The length of the intestinal canal is equal to eleven lengths of the body, including the head and caudal fin, and the whole canal is a simple continuation of the stomach, which differs from the rest of the tube merely in being wider at the anterior extremity. The liver consists of small detached glands dispersed throughout the folds of the intestines, as already described. The only specimens I have seen of this interesting species were found by Mr. Griffith at Suddyah, in Upper Assam. It seems to be confined to the higher parts of the valley where the large rivers fall in rapid currents from the skirts of the mountains, and the water is clear, and the bottom rocky. In such situations I learn from Mr. Griffith that it associates with *Gonorrhynchs*, *Gobio anisurus*, and *Cyprinus semiplotus*.

VII.—GOBIO LIMINOPHILUS, J. M.

t. 55, f. 3, and t. 58. f. 2. β .

This is one of the commonest species in all parts of Bengal, particularly delighting in swamps and ponds, but also common in large rivers where the water is fresh and the currents slow. After my figure had been lithographed, I found a better one in Buchanan's collection named *Cyprinus bangon*, which I suppose to represent a larger individual of the same species, but this has yet to be ascertained, since we find that figures without dissections shewing the structure of parts, are not to be relied upon in this group.

The general proportions, particularly in regard to depth vary a little. The head is equal to about one-fourth part of the length of the body, exclusive of

the head and caudal ; the colours of the back as well as of the caudal and dorsal fins are usually grey : the lower parts as well as adjacent fins are greyish white, with a yellowish tinge often at the base of the fins as well as on the under jaw. The caudal and dorsal fins, together with some of the scales are often tipped with a darker grey ; the lips and snout are thin and hard, the latter is however prominent. The fins are small and feeble, and the dorsal may be said to contain either eleven or ten rays, according as the last may be more or less divided, and the first, which is usually nothing more than a small point situated close to the root of the second, may happen to be more or less developed, but the rays may generally be stated as,

D.10 : P.19 : V.9 : A.7 : C.19.

The alimentary canal is a small but lengthy tube, equal to above eight lengths of the entire fish including the head and caudal ; the liver is disposed in several detached glands, as in the last described species. There are thirty-six scales along the lateral line, and about twelve rows from the base of the ventrals to the dorsum ; the scales are long, and on each there is a tube extending from the base towards the apex for the transmission of mucous to the surface of the body, the same as the tube forming the lateral line, but smaller ; and as these tubes are connected with a glandular structure beneath the scales, the latter consequently adhere more firmly to the body than they do in other species. After a specimen has been kept in spirits for a time, and then exposed to the air until it becomes dry, the scales will be found to present a succession of depressions extending along the middle of each row, caused by the contraction of the mucous ducts which draw the middle of the scales inward, by observing which the peculiarity of this species may be detected. Even in the living state this peculiarity may be observed.

VIII.—*Gobio bicolor*, J. M.

t. 40, f. 1.

The general form and proportions of this species agree very nearly with those of *Gobio isurus*, but in structure it differs essentially from that species. The snout is depressed, smooth, long, soft, and rather pointed; with a few mucous pores, which however cause little or no roughness. The mouth is small and semicircular, and placed horizontally on the lower surface of the head, which is equal to a third length of the body, exclusive of the head and caudal. The eyes are placed on a prominent ridge intermediate between the snout and the branchial aperture. The depth of the body is equal to half the length, exclusive of the head and caudal; the fins are feeble, the pectorals and ventrals about equal in size, and the upper lobe of the caudal is rather longer than the lower; the upper part of the body from the lateral line to the dorsum is a dark blue, the lower parts are white. The fin rays are,

D.12 : P.17 : V.9 : A.7 : C.12.

There are forty-two scales along the lateral line, and thirteen in an oblique row from the base of the ventrals to the dorsum; the scales are short, and their exposed surfaces are rhomboidal as usual. The alimentary canal is equal to eleven lengths of the body inclusive of the head and caudal; and as in the last two species, the liver consists of numerous detached glands dispersed throughout the abdomen.

This species was found by Mr. Griffith (to whom I am indebted for the only specimen I have seen) to inhabit the higher parts of the Bramaputra, where the river becomes rapid and clear, and the bottom composed of boulders.

IX.—*Gobio anisurus*, J. M.

t. 40, f. 2.

This is a small species of which I have only seen one individual, which was found by Mr. Griffith in the higher parts of the Bramaputra.

The length of the head is equal to the altitude of the body, and in proportion to the length of the latter as one to three. The head is a little more compressed than the body, and deep, especially at the snout, which is rough and porous, as well as muscular and prominent. The mouth is small, the lips thick, hard, and smooth without cirri. There are about forty-three scales along the lateral line, and the lower lobe of the caudal is longer than the upper. The fin rays are,

$$D.12 : P.17 : V.9 : A.7 : C.\frac{9}{10}$$

The colour above is dark bluish, softened off on the sides to the lateral line, below which it is white. The scales are lanceolate at the apex, and their structure is nearly uniform at both extremities.

The intestines are of great length, equal at least to those of *G. isurus*; the liver is very obscurely developed, and distributed in minute detached lobes in various parts of the abdomen.

X.—CYPRINUS BOGA, Buch. P. G. t. 28, f. 80.

Cyprinus ariza, id. *Cyprinus pangusia*, id.

The two first are chiefly distinguished from each other by the structure of the lower lip. Of *Cyprinus boga*, Buchanan in one place says, *labeo inferiore crenato*,* and in another, that the under lip is *indented* on the edge.† Of *Cyprinus ariza* he says in one place, *labeo inferiore reflexo, integerrimo; rostro lævi*; in another place he observes of the same species, that the under lip is reflected on the edge, and omits any allusion to a peculiarity of the nose, further than that it is supplied with large pores, but he also remarks this of *Cyprinus boga*. Were I to detail the attempts I have made to distinguish these two species with all the fishes of Bengal that I have been able to

* *Pisc. Gang.* 386.

† *Op. Cit.* 286.

collect in four years before me, I should only contribute to the embarrassment of the question. With regard to the third species, *Cyprinus pangusia*, which according to Buchanan is distinguished by fourteen rays in the dorsal fin, while in each of the former varieties that fin contains only twelve rays, it certainly does appear at first sight to rest on a better footing ; especially as all the species of this group that are without cirri, present a hard prominent snout, and have only twelve rays in the dorsal. I am acquainted however with a variety which for a long time I considered to be *Cyprinus pangusia*, but on re-examination I found two rudimental cirri, and that the rays of the dorsal fin are strictly fifteen, thus making it correspond with the *Rewah*, a variety of *Cyprinus mrigala*.

When we add to these observations the testimony of Buchanan himself, that the three species nearly resemble each other, and compare the striking resemblance that exists between the figure of *Cyprinus boga*, *Pisc. Gang.* t. 28, f. 80, and *Cyprinus pangusia*, t. 42, f. 1, we cannot hesitate in the present state of the question to regard them as one and the same species. Still, however, we ought not to forget the distinctions Buchanan has pointed out, and which have been preserved in the synopsis. The following variety may however be distinct from *Cyprinus boga*, and the drawing of it in Buchanan's collection is marked *Cyprinus pangusia*, although I consider it to be the fish he has described as *Cyprinus ariza*.

CYPRINUS PANGUSIA, Buch.

t. 42, f. 1. β .

The length of the head is equal to the depth of the body, and to a third of the length, exclusive of the head and caudal.

The head is compressed rather more than the body, so as to render it narrow between the eyes. The snout is narrow, but rough, porous, prominent, and soft, without being loose or pendulous ; the under jaw is short and thin, so as to be in a great measure concealed by the snout when the mouth is

closed. The colours above are dark olive green or blue, below white; the pectorals and ventrals are of equal size; the caudal is more divided than that of *Cyp. boga*, Buch. Intestines and stomach form a canal of great length. The fin rays are,

D.12: P.16: V.9: A.7: C.19.

There are forty-three scales along the lateral line, and about fifteen from the base of the ventrals to the dorsum.

XI.—GOBIO RICNORHYNCHUS, J. M.

t. 55, f. 1.

This species I am inclined to think is identical with that which is figured in Hardwicke's Illustrations under the name of *Cyprinus falcata*, although if the figure is to be depended on, (and it is large enough for any purpose) the dorsal would seem to contain thirteen, and the anal eight rays. In Assam I was familiar with a fish which I have since lost from my collection, called *Nepura* by the fishermen, which I considered to be the one figured by Hardwicke. In this opinion I was farther confirmed by a sketch of the same fish which Mr. Griffith had made. Still as a specimen of the Assam fish is wanting, and no description of Hardwicke's figure that I am aware of published, I think it safer to keep the two apart until they are proved to be the same. In the latter case the best of the three names proposed may be selected, or the one applied to Hardwicke's figure by Mr. Gray retained. Should it prove to be a *Gobio* rather than a *Labeo*, either *ricnorhynchus* or *malacostomus*, as proposed in the synopsis, would be equally applicable to it, as the only species in the group with a wrinkled snout and soft pendulous lips. The contents of the abdomen were removed from the only specimen I have seen, and in deciding as to whether it be a *Labeo* or a *Gobio*, perfect specimens ought to be examined.

The length of the head to that of the body is as one to four, the back is arched gradually from the snout to the dorsal, ventral margin nearly straight, depth about a third of the length, forty-three scales along the lateral line, and fourteen in an oblique row from the base of the ventrals to the dorsum. The head is thick and fleshy ; the eyes small, and the lips loose and pendulous. The pectorals and ventrals are of about equal size. The fin rays are,

D.12 : P.17 : V.9 : A.7 : C.19.

The colour above is dark olive-brown, below* yellowish white. The snout is perforated with numerous large mucous pores, and intersected by many deep wrinkles. The specimen here described was found by Mr. Hodgson, by whom it was presented to the Asiatic Society. The *Nepura* of the Assamese I found as low as Bishenath, where the current is slow, and the bottom sandy ; here its colour is deep blue on the back. It is small, and very rarely met with in Lower Assam ; but above the rapids Mr. Griffith says it is very common, and attains a large size, and that the fins and tail are dusky, the body below white, above olive-green. He also observes that it refuses all kinds of bait and flies, although like *Catastomus dyocheilus*, with which it associates, it is frequently seen plunging on the surface.

Remarks on the Genus.

The striking peculiarity of this group consists in the great length of the alimentary canal, and uniformly herbivorous habits of nearly all the species. Their short and feeble fins adapt them to such waters as contain the greatest abundance of plants, from which alone they derive their food. In the numerous dissections I have made of them, *Cyprinus mrigala* is the only one in which I found a trace of any animal remains in the intestines or stomach. Except the last species described, they are confined chiefly to jeels and ponds, but they are also found in the large rivers where the currents are slow ; but they never, I believe, descend with the rivers to within the influence of

salt-water. They are all used as a wholesome food by the people of India ; few of them however attain any very great size, or are much esteemed for their flavour by the wealthy. There is reason, I must observe, to believe that the quality of their flesh varies occasionally according to the ponds from which they are taken.

As they do not prey upon each other, the size of the water into which they are introduced is the only limit to the extent to which they will propagate, provided merely that the *Siluridæ* and similar carnivorous kinds be not allowed to flourish in the same ponds. If the proprietors of tanks were only to allow their fishermen to take the destructive kinds from their ponds for a season or two, such as the various kinds of *Magur*, *Pabda*, *Singhi*, *Boalis*, *Aoar*, *Sal*, &c. they would then find the *Mrigala* and other Bangons so numerous, as to repay the little attention required to prevent their destruction. In Bengal fishes are so abundant that perhaps any great augmentation of their numbers is little to be desired ; but in the North-western Provinces the case is very different, especially where there are few tanks and streams ; and these I have found to be almost entirely abandoned to Pikes and other rapacious species, such as cannot allow the more profitable kinds to multiply, where, from a scarcity of water they ought to be preserved with the greatest care. When fishes are too much crowded in ponds, they are liable to epidemics. In June last, Mr. James Prinsep sent to me a number of Bangons from a pond at the Mint, in which they had become blind, some of one, and others of both eyes. Mr. Prinsep insisted on investigation of the subject, and with the aid of our friend Mr. J. W. Grant, we found the disease to be a dropsical affection of the membranes of the eye, by which an excess of fluid was secreted so as to cause that organ to protrude beyond the orbits, in some cases almost to the size of an egg. The fishes thus affected were all of the same species, *Gobio limnophilus*, and all in the pond were observed to be seized in the same way. The cause of this singular disease was of course less

obvious than its nature ; whether Mr. Prinsep found any peculiarity in the water to account for it or not, I never heard ; and although the circumstance is curious, I mention it chiefly as an instance of Mr. Prinsep's vigilance regarding every thing of interest, however trivial to ordinary observers.

V.—GEN. GONORHYNCHUS.

This genus was formed by the elder Gronovius, author of various memoirs on fishes during the middle of the last century, from a single species found at the Cape of Good Hope ; and though no increase to the number of species has since been made, I find that we have no fewer than eight in India, many of which were described by Buchanan under the sub-generic name *Garra*, in his ninth division of the Cyprins.

Their very remarkable appearance and peculiar habits, pointed them out to Buchanan as a distinct group, but it is not easy to account for Buchanan, as well as all subsequent writers, overlooking their affinity to the Cape fish described by Gronovius. Buchanan observed them to live amongst rocks and stones in rapid mountain torrents and rivers with pure sandy bottoms, on which account some of them are called by the natives *Balitora*, or sand-diggers ; the word *Garra* also refers to the same habit.

The head is long, and covered with a thick integument so as to conceal the branchial rays and opercular plates. The eyes are small, and placed rather more backward than the middle of the head ; the mouth is small, transverse, and situated in the lower surface of the head, and is opened and closed by means of the muscular structure of the snout, which projects considerably in front ; the dorsal and anal fins are small and without spines, the former placed opposite to the ventrals. The vent is situated immediately behind the ventral fins, and not at the front of the anal as in the Gudgeons. The liver is very small, and occupies the front part of the abdominal cavity except in *G. gobioides*, in which, as in some of the Gudgeons, it is either altogether absent, or dispersed

in small scattered glands throughout the folds of the intestines, which usually float in a copious oily secretion.

The Cape species, *G. vulgaris*, Gm. the only one hitherto known, has elongated opercula and branchial membranes; still, from the description given of it by authors, I conceive our Indian species to belong to the same group, although they have short branchial apertures and rays, and are capable of sustaining life for a considerable time out of water. Those I have examined are without a tongue, and the *os. hyoides* enters into the formation of the lower jaw, being prolonged in front between its two lateral limbs which are placed parallel to each other, and united anteriorly by dense fibrous ligaments; these limbs are short, and articulated behind so as to admit of very limited motion in the jaw, which thus resembles a valve, bounded in front by the long projecting snout.

The manner of feeding, for which this structure is intended, has been described in detail in an account of one of the most characteristic species, *G. petrophilus*, J. M. an inhabitant of high alpine streams.* This species subsists on a slimy vegetable production derived from the surface of rocks and stones in clear mountain torrents by swimming with sufficient force over the surface on which the substance grows to uproot it by means of the depressed lower jaw, which is formed for this purpose alone.

It is not yet determined whether all the species have the same habits, as they have not been watched with sufficient care; but as they are always found in clear mountain streams on rocky bottoms, or in the larger rivers along the skirts of mountains, it is probable they all agree more or less in their mode of procuring food.

In the extraordinary length of their abdominal canal, they are only, if at all, surpassed by the Gudgeons, and the entire tube is filled with a green slimy substance, consisting no doubt of confervoid plants.

* Jour. As. Soc. Beng. Vol. iv, p. 39, where it is named Kemaon trout.

Some of the Gudgeons might from the situation of the mouth be described as Gonorhynchs; the latter differ from the former chiefly in having the lower jaw formed for uprooting a scanty food derived from plants that are fixed, rather than for merely collecting such as are loose and floating plentifully throughout the waters they inhabit. The two groups have therefore the nearest affinities to each other, the nature of the food, and the structure of the digestive organs being nearly the same in both. The difference between them arises rather from the circumstances in which they are respectively placed, than from any thing peculiar to the nature of either, that the other does not possess; and may be traced perhaps to an easy existence on the one hand, in the still waters of ponds and lakes, amidst abundance of food derived from loose, floating vegetation; and, on the other, to the precarious struggle for life in mountain torrents, liable to sudden and violent floods, which as suddenly subside. These conditions seem to allow of the weak jaws, clumsy bodies, and feeble fins of the Gudgeons; and to require in the Gonorhynchs a structure more adapted to battle against the difficulties of their situation in the cold rocky streams of high altitudes, where aquatic vegetation is scanty, and only to be obtained by force from the slippery surface of boulders, and water-worn rocks. The most remarkable character which belongs to the group, is a circular disk or sucker, which is placed on the lower surface of the head, behind the lower jaw. This is no doubt used in cases of difficulty for adhering to rocks, and thus resisting the violence of mountain torrents which, without such a contrivance they would be unable to withstand. This character, no less than the inferior position and structure of the mouth, seems to indicate a relation with the *Palatycara*, Lampreys, and *Cyclopterus*. Their fins are strong, but not large, and the rays are soft, and often enclosed in a thick membrane: their bodies are elongated, by which they are rendered more manageable in rapid currents, while the peculiar structure of the lower jaw affords an instrument singularly adapted for obtaining the only food procurable in the rocky basins to which they are confined. These

peculiarities, although perhaps more remarkably developed in this than in any other group, do not alone belong to the Gonorhynchs, but are in some degree shared by the no less remarkable group *Oreinus*. Both seem to possess in the highest degree a structure that should enable them to survive in situations where the proper element of fishes is most disturbed, and most exempt from the extraneous objects which constitute the ordinary food of their class. Whether any other kind of fishes may yet be found in still higher altitudes than those at which the Gonorhynchs and Mountain Barbels disappear, is a problem in the distribution of this class of animals, that travellers in the Himalaya, and other lofty regions must decide. In the limpid streams which Mr. Griffith passed with Captain Pemberton, at elevations of from six to eight thousand feet in Boutan, no inhabitants were found; and both here and at Simla, as well as in Kemaon, the Gonorhynchs and Mountain Barbels have not been found at greater altitudes than six thousand feet above the level of the sea, where we may presume they disappear; but from that altitude downwards to the plains, they constitute the prevailing forms that have hitherto been met with in the waters.

I.—GONORHYNCHUS GOBIOIDES, J. M.

t. 43. f. 1.

Herilwa of the Assamese.

This is the shortest and most robust species of the group, and corresponds in its figure considerably with the Gudgeons. It is probably the species named *Cyprinus mosario* by Buchanan, but as that author has not left a figure of the species he alluded to, or any other description than merely the number of the fin rays, and the absence of cirri, his name could only be adopted with doubt.

The length of the head is equal to the altitude of the body, and in proportion to its length as one to four. The back and lower margin are equally arched, and the head is prolonged in front of the mouth, where it terminates in a soft fleshy snout. The lower surface of the head is flat, containing the

mouth which is small, transverse, and opened horizontally by the muscles of the snout; the anterior lip is fimbriated, the posterior, hard and cartilaginous. In this species there is no disk behind the mouth. Thirty-seven scales are ranged along the lateral line, and nine rows across the body from the base of the ventrals to the dorsum; colour green above, below silvery. The fin rays are,

D.10 : P.15 : V.9 : A.7 : C.19.

The alimentary canal is eight lengths of the body including the head and caudal, of considerable diameter or capacity, and loaded at all times from the throat to the vent with a green vegetable matter. The liver was not observed in many of the specimens examined; in others, small hepatic glands seemed to be dispersed throughout the folds of the intestines, as in many of the Gudgeons: and in such as present this peculiar form of liver, the whole of the abdominal viscera float in a dark oily kind of fluid.

The nature and source of this secretion in most of the Gudgeons and Gonorrhynchs will require to be farther inquired into. I have found it in those species in which the liver is normal, as well as in those in which that organ seemed to be represented by small detached glands. I have also observed that either this fluid, or the great proportion of vegetable matter contained in the intestines of the Gudgeons and Gonorrhynchs, tends rapidly to putrefaction; to which cause, as well as to the neglect of removing the viscera from these species immediately after they are caught, I ascribe the bad effects which have by some been observed to result on certain occasions from their use. Dr. Campbell, of Nipal, describes a case in one of Corbyn's Journals in which deleterious effects were produced by a common fish in the streams at Katmandu, which he supposed to be identical with a Kemaon species, *Gonorrhynchus petrophilus*. Mr. Bruce, of Assam, also mentioned to me, that he knew of instances of indisposition supposed to be occasioned by a variety of Bangon. All Bangons and Gonorrhynchs should therefore have the viscera removed soon after they are taken, and the dark oily fluid washed away; when, if it be

necessary, they will keep fresh as long as any other kind of fish; but if this be neglected, the stomach rapidly putrifies, in which state if it be necessary to use these fish, the thin parts adjoining the ventral fins should be removed.

II.—GONORHYNCHUS PETROPHILUS, J. M.

Journ. Asiat. Soc. Beng. 4. t. 1.

For an account of this species I must refer to the fourth volume of the Society's Journal, in which its habits are fully described under the head of 'Kemaon Trout,'—the name given to it by English sportsmen, not from the sport it afforded, as it could not be induced to take flies or any sort of bait. The lower jaw is a mere valve placed on the under surface of the head, and used for uprooting and sucking into the mouth the slimy vegetation that accumulates on the surface of rocks submerged in clear mountain torrents. The snout is elongated and muscular, without cirri; the scales are minute, and a double row of pores for the transmission of mucous are ranged along the lateral line. There are eight or nine rays in the dorsal fin, and the intestines are about eight lengths of the body, including the head and caudal fin. It inhabits streams in Kemaon at an elevation of 6,000 feet above the sea, and has been observed by Lieut. Hutton at similar elevations in the mountains north of Simla, as well as by Dr. Campbell in Nipal. The fishes of the Himalaya are as yet but little known, and the characters which I formerly gave of this species are now unsatisfactory even to myself; it is therefore to be hoped that residents in mountain districts will contribute small collections of the fishes of their neighbourhood to our Museum, or to other scientific institutions, where they may be properly examined. Should I be honored with any such consignments, the parties forwarding them may rest assured of their receiving as prompt an attention as circumstances may admit of.

III.—GONORHYNCHUS MACROSOMUS, J. M.

t. 43, f. 7. β *Cyprinus latius*,* Buch.

This species appears to be very widely distributed, having been found by Buchanan in the Tista river, at the foot of the Sekim mountains on the northern frontier of Bengal, and by Mr. Griffith in the cataracts of the Brama-putra, in the eastern extremity of Assam. A small collection of fishes made by Captain Hannay in the rapids of various rivers in Assam, also contained many examples of this species. The length of the head is equal to the altitude of the body, and to one-sixth part of the entire length. The eyes are placed somewhat behind the middle of the head, and two short cirri are placed at either side of the snout, which is long, round, and muscular; the anterior lip is fimbriated on the edge, the posterior lip smooth, the mouth small, and transverse. Thirty-nine scales are placed along the lateral line, and ten in an oblique row from the base of the ventrals to the dorsum. The fin rays are long, and in number as follows,

D.11 : P.14 : V.8 : A.7 : C.19.

The two first rays of the anal are closely united. The general colour is dusky greenish blue, diminishing in intensity on the sides, belly, and fins. The three species above described are the largest of the group, usually attaining six or eight inches in length.

* By giving a Latin termination to *Lati*, the native name of this species, Buchanan has rendered it the most inappropriate that could be invented. So far from it being broad, it is the longest proportioned form among the *Pæonominæ*, and is in fact a true representative of the anguilliform fishes.

IV.—GONORHYNCHUS BREVIS, J. M.

t. 43, f. 6. β .*Cyprinus gohama*, Buch. *Cyprinus dyangra*. id. Coll.

This species I have not met with, but it has been found by Buchanan in the Kosi river, in the north-western parts of Bengal, as well as in the Ganges. It appears to differ from the former in being of shorter proportions, and by having one ray more in the anal fin, which with the ventrals and pectorals are thin and pelucid; only that Buchanan states that it contains two cirri, his description might be referred to *G. gobioides*.

In his collection of figures, however, Buchanan seems clearly enough to point out the species to which he alludes in his description, although he has there given it a different name.

V.—GONORHYNCHUS RUPECULUS, J. M.

t. 43. f. 4. 5.

This species has the under surface of the head flat, with a cartilaginous disk or sucker behind the mouth; snout broad, smooth, depressed, with a row of open pores extending round the snout between the nostrils, and another row between the eyes; mouth very small, vertical, and fleshy; pectorals round; fin rays short, soft, and the membrane in which they are enveloped thick and opaque.

D.8 : P.10 : V.9 : A.6 : C.20.

Colour yellowish white below, and dark brown above, without spots. Thirty-five scales along the lateral line, and nine rows on either side between the dorsal and ventrals. The specimen from which this description has been taken was found by Mr. Griffith in the Laeeh river a few miles beyond Bramacund, at an elevation of 1000 feet in the Mishmee mountains, lat. $27^{\circ} 45'$ N. long. $96^{\circ} 20'$ E. The abdominal canal is very narrow, and about eight lengths of the body.

With it was found the following, which though I have described as a species, may only prove to be a variety.

VI.—GONORHYNCHUS BRACHYPTERUS, J. M.

Under surface of the head flat, with a cartilaginous disk behind the mouth; two very minute cirri and a few irregular pores on the snout; there are thirty-six scales along the lateral line, and seven rows between the ventrals and dorsal on either side.

D.8 : P.14 : V.9 : A.7 or 6 : C.19.

The disk or sucker is, as usual in all the species in which it is fully developed, of an oval form; composed of cartilage slightly elevated in the middle, but hollow externally, and surrounded with a loose membranous margin.

VII.—GONORHYNCHUS BIMACULATUS, J. M.

t. 42, f. 2. β

This species, which is figured in Buchanan's collection under the name of *Cyprinus godiyava*, is, I conceive, the one described in the Gangetic Fishes as *Cyprinus lamta*, which was found by Buchanan in rivulets with rocky bottoms in the province of Behar, as well as in the Gorrockpore district. In a small collection of fishes presented to the Asiatic Society by Mr. Hodgson of Nipal, I find a specimen which seems to correspond equally with the figure and description given by Buchanan. The following is its description—Pectorals rounded, snout with two very minute cirri, rough, divided by a deep fissure, and studded with large irregular pores; behind the mouth there is a smooth callous sucker, and at the base of the caudal fin on either side, a black spot. The fin rays are,

D.10 : P.13 : V.9 : A.7 : C.19.

Thirty-five scales along the lateral line, and seven rows from the base of the ventrals to the dorsum. The following may perhaps be regarded as a different species,

VIII.—*GONORHYNCHUS CAUDATUS*, J. M.

Snout warty, porous, and divided by a horizontal fissure, without cirri; a black spot at the base of the caudal; lower lobe of the caudal longer than the upper; thirty-four scales along the lateral line, and eight rows from the base of the ventrals to the dorsum. This species, if it may be so called, corresponds in other respects with *G. bimaculatus*. It was found by Mr. Griffith in the Mishmee mountains.

IX.—*GONORHYNCHUS FIMBRIATUS*, J. M.

t. 43, f. 3. β

Cyprinus sada, Buch.

This species is distinguished by four cirri shorter than the head, the lateral line is placed high on the sides, and the dorsal fin anterior to the middle of the back. The fin rays are,

D.13 : P.— : V.9 : A.7 : C.

Colour green above, and silvery below. This would seem to be an alpine form although it wants the sub-maxillary sucker, and was found by Buchanan in the Bramaputra in Lower Assam. I have not met with it, and can therefore add nothing to the information given regarding it in the Gangetic Fishes.

To this group must also be added *Cyprinus gotyla*, Gray, Hardwicke's Illustrations, t. 5, f. 3, said to have been found in the mountains of India. In the synopsis I have stated what seem to be its distinguishing characters. Since the paper has gone thus far through the press, the first volume of Mr. Swainson's work on the Natural History of Fishes, Amphibians, and Reptiles,

Lond. 1838, has reached me, and affords many observations in corroboration of the results to which I have been led in the analysis of Indian *Cyprinidæ*, particularly in the formation of the aberrant groups of the family. Speaking of the apodal order, to which the Gonorhynchs present many relations, as well in their lengthened cylindric forms, thick integuments, and submaxillary sucker with which they are furnished, Mr. Swainson says, "it would seem, indeed, that nature upon leaving the annulose circle, and entering that of the fish, intended to show us all the forms of variation in the first group, which she afterwards employs to characterise higher divisions: this she has done in the class *Acrita*, as Mr. Macleay has so beautifully illustrated in the "*Horæ Entomologicæ*;" and in confirmation of this, we now find the apodal forms reappear, not alone among the *Pæonominæ* as in the Gonorhynchs, but also in the *Platy cara* and *Cobitinæ*, thus marking the most distant groups with certain types, through which the character of annulose animals, or worms, may be traced. Unacquainted before with this analogy, yet in the formation of aberrant groups I have been led to the development of its truth by another path, than the one which led to its detection by Mr. Swainson.

II.—SUB-FAM.—SARCOBORINÆ, J. M.

CHARACTERS.—*A blunt knob on the apex of the lower jaw, more or less distinct; intestinal canal short; colours bright. Like the Pæonominæ, they are confined to fresh water, but their habits are carnivorous; size small. Three rays in the branchial membrane.*

The first object is to show that the relations of this sub-family to the *Pæonominæ* are parallel, and therefore that the two groups are distinct. The number of types representing genera in each sub-family are apparently five, some of them are very well made out; as for instance, *Cirrhinus*, *Barbus*, *Gobio*, and *Gonorhynchus* among the *Pæonominæ*; and *Systomus*, *Perilampus*,

Leuciscus and *Opsarius* among the *Sarcoborinæ*. It remains, however, to be determined from the materials of other parts of the world, whether the *Catastomi* and *Labes* may not be united with the *Cirrhini*, and *Cyprinus carpio* with the Barbels, or retained as the type of distinct groups to which *Cyprinus semiplotus*, J. M. and other similar species may be united. It remains in like manner to be determined, whether the Breams are to be placed with the *Pæonominæ*, or, as the only Indian species indicates, with the *Sarcoborinæ*; and in the latter case, if they may not be united in one group with the *Perilamps*.

It is these doubts, which can only be settled by a direct appeal to the species of other countries, that renders a comparison of the two groups in this place somewhat unsatisfactory. Without attempting to speculate on the subject, we may at once compare together those genera in both sub-families with which we are best acquainted.

The head and body in the genus *Barbus* are long, and slender, but in the genus *Systomus* short and deep: the Barbels blend in their direct affinities with the herbivorous forms; and the *Systoms* with the carnivorous. The same result will attend the comparison of any of the other groups of the two sub-families, as the *Opsarions* and Barbels: both have the body and head long and slender, and are the most carnivorous in their respective groups; both have short dorsal fins, and the head much elongated behind the eyes; but here their relations end. The Barbels are without an armature on the jaws, and have a long, narrow stomach and intestinal canal, and feed upon small fishes and plants: the *Opsarions*, on the other hand, have a capacious fleshy stomach, an armature on the lower jaw, and the power of seizing and swallowing piecemeal species wonderfully approaching their own size. In the one case the characters blend with the herbivorous, in the other with the carnivorous *Cyprins*; thus proving such relations as do exist to be those of analogy, and not of affinity. The affinities of the Barbels are indeed well understood to be confined to the *Pæonominæ*. The direct affinities of the *Opsarions* with

the Perilamps and Leuciscs are, on the other hand, clearly enough confined to *Sarcoborinæ*; but there is a group still required to fill up the space between the Opsarions and the *Apalopterinae* in order to complete the *Sarcoborinæ*, and unite that group with the aberrant circle. Whether the American genus *Amia*, or the genus *Sudis*, Cuv., or *Erythrinus*, Gronov. which all naturalists suppose to present near relations to *Cyprinidæ*, may, one or all, be destined to fill up this blank, is a question regarding which, without those genera before me, I cannot venture an opinion. *Amia*, I may remark, is said to be without cæcal appendages to the stomach, a circumstance which ought to place it with the Cyprins, rather than with the *Clupeidæ*.

It may be necessary to explain in this place why I have given the two principal groups of *Cyprinidæ* the rank of sub-families, rather than that of mere genera. A genus appears to have been intended as the lowest denomination of a perfect group; and, indeed, is still so regarded that no smaller groups are supposed to be comprised within it, although where the species are numerous they may be conveniently separated into artificial sections, or sub-genera. Should such sections be further augmented, so as to become necessary to separate them still farther, it is obvious that this can only be done by augmenting the value of the higher group, by raising it to the rank of a family, or sub-family, when the sub-genus would naturally become a genus. This is what I have done; and though a species may be so isolated, as to form a distinct family of itself, by means of the numerous links that would be requisite to connect it with the nearest known forms being lost, or undiscovered, yet this is so unlikely now to be the case in zoology, that we may regard the number of genera as the safest rule for determining the value of groups; and as genera are understood to be the lowest denomination of perfect groups, and sub-genera mere artificial sections of genera, we can have no uncertainty in the nomenclature of groups; though I am aware that for want of a little reflection on this subject, the distinction between genus and sub-genus is often confounded, or ill understood.

This sub-family includes the several divisions into which Indian species have been separated by Buchanan, under the terms *Chela*, *Barilius*, *Puntius*, *Danio*, *Marulius*, and *Cabdio*, which were merely characterised by that author as having no resemblance to other genera. Indeed it would have been impossible in Buchanan's time to have assigned positive characters by which the *Sarcoborinæ*, or their subordinate groups, could be distinguished, without a knowledge of the discoveries that have been made by Mr. Macleay. In the introduction to the *Gangetic Fishes*, we are told that to have adopted the improvements introduced by Cuvier, whose system appeared after the M.S. had been prepared for the press, would have occasioned a trouble for which there would not have been a sufficient counterbalance; and indeed that system alone, without the aid of Mr. Macleay's views, which appeared about the same time, would have afforded very little assistance in this family. It is impossible, however, not to admire the excellent notions of natural affinities which are apparent in every part of Buchanan's work, but particularly in the genus *Cyprinus*, where he was induced to cast aside all respect for systematic writers, and to act independently of their authority. All that can be regretted is, that more care had not been bestowed by him in characterising the new groups which he proposed, of which *Chela* alone appears to be the only one that has been adopted, and that merely from a supposed affinity which it presents to *Clupeæ* or Herrings. The *Chelæ*, however, strictly speaking, consist only of three or four aberrant forms, whose affinities lie between the Perilamps and Opsarions.

I.—GEN. SYSTOMUS, J. M.

The head is small, oval, and smooth; the mouth is small, and when opened the intermaxillaries are drawn forward so as to form a somewhat cylindrical tube; the tongue is thick and fleshy; the dorsal, placed in the middle of the back, is composed of rather long, but not numerous rays preceded by a spine, and placed opposite to the ventrals; the body is deep, short, compressed, and

salient on the upper margin, but less prominent below ; the colours are usually distributed in peculiar spots and streaks ; the scales are large. The species are numerous, and of small size, but very abundantly distributed throughout the ponds of Bengal, Assam, and indeed the waters of all parts of India.

The stomach is a long, narrow, fleshy tube, terminating in a single intestine, which in most of the species is twisted round the stomach like the thread of a screw, see Pl. 54. f. 12. *a*, œsophagus, *b*, is the vent. The entire length of the canal does not however in any case exceed thrice that of the body. The air-vessel and liver are fully developed, and present slight variations of form in the different species, but agree generally with the same organs in the Cirrhins. From the shortness of the intestinal tube compared with that of *Pæonominæ*, as well as on account of their bright colours, and the peculiarities of the mouth, which seems to be constructed chiefly for insect food—the remains of this having been found abundantly in their stomach—these fishes are placed with the *Sarcoborinæ*. Their protractile jaws, often supplied with cirri or muscular filaments, and their comparatively elaborate digestive organs, indicate, on the other hand, a perfection of structure compared with the other genera of *Sarcoborinæ*, that naturally raises them to the first place in that sub-family, of which they consequently become the typical group.

I.—SYSTEMUS IMMACULATUS, J. M.

Pl. 44. f. 5.

Entire length equal to about twice the depth, back arched equally from the snout to the dorsal fin ; the upper half of the dorsal spine serrated behind ; thirty-two scales along the lateral line, and ten in an oblique line from the base of the ventrals to the dorsum. Four small cirri. The fin rays are,

D.11 : P.15 : V.9 : A.7 : C.19.

Colour green above, below greenish white, fins pale, and a tinge of red on the opercula. The stomach widens at the œsophageal extremity, and the

posterior cell of the air-vessel terminates in a sharp point. *Systomus chrysosomus* of the synopsis is probably a variety only of this species, which is generally distributed throughout the rivers and ponds of all parts of India, sometimes weighing as much as two pounds, but generally much smaller; it is however taken in vast abundance in some places, which makes up for its deficiency in size; it is considered a sweet, wholesome food.

II.—*SYSTOMUS CHRYSOPTERUS*, J. M.

A short, well formed little species with red pectoral and ventral fins, without cirri or spots; each operculum tinged with red; upper parts of the body olive green, below silvery. The fin rays are,

D.9 : P.13 : V.9 : A.7 : C.18.

Twenty three scales along the lateral line, and eight in an oblique line from the base of the ventrals to the dorsum; the second ray of the dorsal spinous, but smooth behind. This species would require to be further examined; it abounds in the Bramaputra in Lower Assam, in the early part of the cold season.

III.—*SYSTOMUS TETRARUPAGUS*, J. M.

t. 44. f. 3.

Cyp. titius, Buch. P. G. *Borajalee* of the Assamese.

Depth of the body compared to the entire length, including the head and caudal, as one to three; body equally arched above and below, a black spot at either end of the lateral line. The fin rays are,

D.10 : P.12 : V.9 : A.7 : C.20.

The stomach is a narrow fleshy tube, ending in a still narrower dark coloured intestine; which, together with the stomach, is not much above the length of the body.

This is a very common species in the Bramaputra, and is found in great abundance along with the last described.

IV.—CYPRINUS SOPHORE, Buch.

Op. Cit. t. 19. f. 86.

Without cirri Short and elevated body with large scales, green above, below silvery, with a distinct black spot on the lower part of the dorsal fin, and another at the end of the tail ; and a diffuse yellow spot on the opercula.

D.10 : P.14 : V.9 : A.7 : C.19.

Buchanan states that this species is common in the ponds throughout Bengal. A small collection of fishes forwarded to me by Dr. Macleod, Insp. General of Hospitals, from Hazareebagh, a place about one thousand feet above the plains, contained examples of this species.

V.—CYPRINUS TICTO, Buch.

Op. Cit. Pl. 8. f. 87.

Mouth small, without moveable intermaxillaries, lower jaw rather longer than the upper, formed of two limbs placed parallel to each other, and affording a slight prominence at the apex ; intestine twice the length of the body.

The depth of the body is equal to half its length, exclusive of the head and caudal ; scales large, twenty-four on the lateral line, and eight in depth from the base of the dorsal to the ventral on either side. The dorsal is placed on a high and sharp ridge, the arch of the back extending equally from the base of the fin to the snout ; the lower margin of the body is less prominent than the upper ; there is a black spot at either extremity of the lateral line, and one on the dorsal fin ; the first three rays of the dorsal are united, and spiny. Fin rays are,

D.11 : P.15 very small : V.9 : A.7 : C.20.

Colour above dark green or purple, below silvery ; length, about two inches. Though small, this species occurs in such vast numbers as to be extremely important as a wholesome and nutritious article of food ; they are generally taken in casting nets, which at every draught bring up a large number from almost any pond in Bengal and Assam.

A variety of this species with two rows of dots on the dorsal is figured by Buchanan as *Cyp. bimaculatus*, but as it has two black spots on each side, it should rather have been named *quadrimaculatus*.

Buchanan alludes to a species which he named *Cyp. tictis*, the description of which he postponed in hopes of recovering his drawings which were retained in India.

VI.—SYSTEMUS PYRROPTERUS, J. M.

Pl. 44. f. 1.

Depth equal to half the length, but the body and head are thinner, or more compressed than in any of the other species ; there is a black spot on the lateral line over the anal fin ; the second ray of the dorsal fin is strong ; mouth furnished with a small hook on the apex of the lower jaw ; twenty-four scales along the lateral line, and nine in an oblique row from the base of the ventrals to the dorsum. The fin rays are,

D.9 : P.12 : V.9 : A.7 : C.19.

Colour above green, below silvery stained with orange on the sides, fins bright red.

The abdominal canal of this species is thrice the length of the body, exclusive of the head and caudal. It is very numerous in ponds in Upper Assam, seldom attaining a larger size than two inches in length.

VII.—CYPRINUS CONCHONIUS, Buch.

t. 44. f. 8. β .*Konchon pungti* of the fishermen.

One black spot near the middle of the tail as in *S. pyrropterus*, but the body is shorter and deeper; colour greenish above, and silvery below; fins pale; second ray of the dorsal spinous and serrated behind. The fin rays are,

D.10 : P.10 : V.9 : A.8 : C.19.

In the waters of Behar, Buchanan observes, the fins are blackish in this species, and still farther west in a stagnant river full of weeds it had the belly stained with black, while the dorsal and caudal were yellow, tipt with black.

VIII.—CYPRINUS CHOLA, Buch.

t. 56 f. 3. β .*Chola pungti* of the fishermen.

Depth equal to half the length; arch of the back rising abruptly from the nape to the base of the dorsal; two very small cirri; third ray of the dorsal spinous, but smooth-edged; scales large, twenty-six in a line along each side, and nine in an oblique line from the base of the ventrals to the dorsum. The fin rays are,

D.11 : P.15 : V.9 : A.7 : C.19.

Ventrals bright red, pectorals, anal, and opercula stained red, and an indistinct blackish spot on the tail; above olive green, below silvery.

The alimentary canal is very small, and about twice the length of the body.

Casting a net into a pond in Middle Assam, not presenting any remarkable appearance of containing fish, about 120 were brought up at a single draught; of these forty were *S. pyrropterus*, thirty *Cyprinus chola*, fifteen,

C. sophore, eight *S. immaculatus*, ten *Anabas scandens*, Cuv., five *Esox cancula*, Buch., five *Opsarius fasciatus*, J. M., and two *Silurus singo*, Buch. and five *Trichopodus colisa*, id. With the exception of the *Trichopodus* the five last kinds prey upon the *Systomi*, which are themselves insectivorous. The extent of the pond may have been 400 yards, and that of the net three yards; and supposing half the fish to have escaped from under the net, the number in the pond would have been 32,000. When we consider the vast extent of surface occupied by waters equally productive, both in Bengal and Assam, we may form a conception of the inexhaustible supply of fish that might be procured for consumption in other parts of the country where they are less plentiful.

IX.—*SYSTOMUS GIBBOSUS*, J. M.

t. 44, f. 7. β.

Cyp. Terio, Buch.

Teri pungti of the fishermen.

Back abruptly arched from the nape to the base of the dorsal, belly straight from the pectorals to the anal, which is placed on an oblique base, as in the Barbels. There is a distinct black spot on the lateral line over the anal. The fin rays are,

D.11 : P.13 : V.9 : A.8 : C.19.

Colours above green, below silvery, the fins pale, the nape, snout, and part of the operculum marked each with a yellow diffuse spot. This and the following species were found by Buchanan in the north eastern parts of Bengal, and are beautifully figured in his collection of drawings. Buchanan says that in old individuals the spot on the tail becomes surrounded by a faint ring.

X.—SYSTEMUS MALACOPTERUS, J. M.

t. 44. f. 9. β .*Cyp. cosuatis*, Buch.*Koswati* of the fishermen.

Back abruptly arched from the nape to the dorsal, which is somewhat rounded and without a spine; scales large, and black at their bases; lower margin of the body uniformly rounded. The fin rays are,

D.10 : P.15 : V.9 : A.7 : C. $\frac{10}{9}$.

Colour above greenish, without any distinct spots on the sides, below silvery, ventrals light red, other fins pale; found by Buchanan in the Kosi river in the north-western parts of Bengal. I have not hesitated to place it in this group, as well from its general characters as from the remark of Buchanan, that the "jaws protrude much in opening."

The three remaining species are slightly diaphanous, with a chaste and beautiful variety of colour distinctly distributed over the body. The lobes of the caudal are not separated by a deep fissure, thus indicating an affinity to the Perilamps; and as such peculiarity of form and diversity in the fixed colours indicate in all similar cases throughout the *Cyprinidæ* carnivorous habits and structure, I cannot view these species as an exception to the rule, until they are proved to be so.

XI.—CYPRINUS GELIUS, Buch.

t. 44. f. 4. β .*Geli pungti* of the fishermen.

Abdomen and a stripe on each side silvery, an irregular black spot extends over the first three or four rays of the dorsal, as well as ventrals and

anal; a black bar across the tail, and another behind the pellucid abdomen; eyes rather large and elevated. Fin rays,

D.10 : P.13 : V.9 : A.8 : C.19.

Second ray of the dorsal serrated behind. Twenty-five scales along the lateral line, and eight in an oblique row from the base of the ventrals to the dorsum. It is a beautiful little species very common in the Sunderbuns, and is usually found about an inch in length

XII.—*SYSTOMUS LEPTOSOMUS*, J. M.

t. 44. f. 2. β.

Cyp. phutunio, Buch.

Green above, abdomen silvery, five black transverse streaks on the sides; ventrals red, second ray of the dorsal indented behind. Fin rays are,

D.10 : P.12 : V.8 : A.7 : C.19.

This species is still smaller than the last, and very much resembles it; but there are only twenty scales in each row on the sides. It is also found in the Sunderbuns where it is caught in creeks, on the return of the tide, by means of small baskets, it is then dried in the sun, and though hardly an inch in length, affords with *Cyp. gelius*, *Cyp. canius*, *Perilampus striatus*, and other equally small species, a considerable supply of food to the poorer classes. Where the larger species are so plentiful, these small kinds are only sought for from the ease with which they may be preserved without salt.

XIII.—*CYPRINUS CANIUS*, Buch.

t. 44. f. 6. β.

Abdomen, opercula, and lateral line silvery; several black spots on the sides, with a black spot at the base of each of the ventrals, and at that of the dorsal and anal fins; rest of the body and fins red, second ray of the dorsal serrated behind.

II.—GEN. ABRAMIS, Cuv.

Body short and elevated, a short dorsal is placed opposite to the ventrals : anal long, colours plain.

The following is the only species yet found in India.

CYPRINUS COTIS, Buch.

Back raised suddenly from the nape to a salient point, behind which the dorsal is placed ; in front of the first ray of the dorsal there is a small dark spot, but all the rest of the body is silvery. The fin rays are,

D.10 : P.13 : V.10 : A.32 : C.19.

Buchanan makes them,

D.10 : P.16 : V.12 : A.36 : C.19.

Until it be shewn that we have described different species, which I do not think we have, the discrepancy may be supposed to have arisen from the difficulty of counting the fin rays.

The intestine is continuous with a small elongated stomach, and the whole tube scarcely exceeds the entire length of the fish, including the head and caudal

III.—GEN. PERILAMPUS, J. M.

The Breams, as defined in the Règne Animal, are *Cyprinidæ* that have neither spines nor cirri, their dorsal is short and placed behind the ventrals, and their anal is long. This was quite sufficient to embrace the few species that were known at the time ; for although several editions of the zoological system of Cuvier appeared subsequently to the publication of the Gangetic Fishes, in which many of the species composing the genus *Perilampus* are described, yet the retention of Buchanan's drawings in India not only deprived

that author of much of the merit to which his labours as a naturalist entitled him, but the world at large of the masterly elucidation of this subject that might have been expected from the hand of Cuvier.

Notwithstanding the very general assemblage of forms that Cuvier's definition of the genus *Abramis* might be supposed to admit, the European species only amount to five, and three of these are peculiar to the tributaries of the Baltic. I found, however, upon a close examination of Indian *Cyprinidæ* that if we were to content ourselves with the characters given of the Breams by systematic writers, we should not only confound at least two natural groups, but augment our Indian species of that genus to about thirty five in number.

From this vast accession of materials, for which we are chiefly indebted to Buchanan, I am enabled to distinguish two natural genera, *Perilampus* and *Opsarius*, and to suggest something like natural limits to the hitherto ill defined genus *Leuciscus*. Before entering upon the consideration of any one of these groups, it is necessary to offer a few remarks on their general distinctions.

The Perilamps, so called from the brilliancy and variety of their colours, as well as the Opsarions, or fish-eaters, seize their prey by means of a sudden effort or spring, for the performance of which the great breadth of fin appears to be accumulated behind. The mouth is armed with a prominent knob on the apex of the lower jaw, more or less sharp in the several species; when the mouth is closed this knob is received into a corresponding fissure in the upper jaw: thus far the two groups agree, but in the general development of their forms and structure, nature has assigned to each a totally distinct organization, adapted to the peculiar ends for which the species were designed. Between the two groups here alluded to the *Leucisci* occur, consisting perhaps of species that might be referred on the one side to the Perilamps, and on the other to Opsarions, rather than forming, by any distinct structure or habits of their own, a natural group.

The Perilamps, or first of the three groups in question, seem to follow the Breams as next in the direct relations of habit and structure. Our only Indian Bream has the short alimentary canal of the *Sarcoborinæ*, and those of Europe appear to indicate a somewhat corresponding disposition for animal food. Such is particularly the case with *Abramis blicca* which, when seizing live bait, according to Mr. Yarrell, is more prone to rise than to descend, causing the float to lie horizontally on the water rather than to drag it like other species beneath the surface. This may or may not indicate an affinity to the habits of the Perilamps, though the form and colour of the species in question are in favour of the affirmative; I merely allude to this peculiarity, which is referred to by Mr. Yarrell on the authority of Mr. Lubbock, as a singular circumstance, probably capable of explanation by reason of the affinity here suggested.

The first species in which we observe a decided approach to the characters of the Perilamps is *Cyprinus devario*, Buch., which combines the long anal and form of a Bream with the dorsal of a *Cyprinus proprius*, and the mouth and real markings of a *Perilampus*. As the latter group, and consequently the peculiarities by which its species are distinguished were unknown until now, some of the most striking characters which belong to it were lost sight of in the figure of *Cyprinus devario* given by Buchanan. The mouth is directed upward, and although the peculiar prominence of the apex of the lower jaw is absent on this species, yet the deficiency in this respect is compensated for by a slight roughness on the lower jaw, first observed by Buchanan, and which he thought "might perhaps be considered to be teeth," without a suspicion that an indication of any maxillary structure equivalent to prehensile teeth in this family should prove the carnivorous propensities of the species possessed of such peculiarity, and that both in structure and mode of life they should be found perfectly distinct from ordinary Cyprins.

PERILAMPUS, J. M.

CHARACTERS.—Head small and raised, suborbital plates broad below, and narrow behind the eyes: mouth small, and directed upward, so that the apices of the jaws are raised to the altitude of the crown, the lower jaw is armed at the point with a blunt knob or equivalent organ to teeth. The tongue is thick and wrinkled. The body is much compressed; the back straight or only very slightly raised under the dorsal; the belly or lower margin is very prominent, and the sides are marked with bright colours, mostly blue. The caudal is large, a small dorsal is placed opposite to a large anal, the ventrals and pectorals are small, but in some the ventrals are composed of elongated rays, apparently to facilitate the effort to rise into the air.

They are without spines, and often with long setaceous cirri.

I.—CYPRINUS DEVARIO, Buch.

t. 45. f. 2.—P. G. t. 61. f. 94.

This species has been referred by Cuvier to his sub-genus *Cyprinus pro-*
prius. To me that group does not seem to be either natural or well defined, in as much as the dorsal spine is by no means commonly associated with a lengthy dorsal fin; indeed both the characters alluded to are so artificial that they cannot be had recourse to in forming any group of *Cyprinidæ*. Authors from a diffidence to reject altogether a group that has received the sanction of so high an authority as Cuvier, are continually in the habit of modifying the characters of the group in question, to suit the particular species they meet with, as I have done to bring *Cyprinus semiplotus* into it; but were I acquainted sufficiently with European species, I might have had no hesitation in making *Cyprinus semiplotus* the type of a new group. *Cyprinus carpio*, on which the group is founded, seems to me to be strictly a Barbel, uniting that genus with

the Cirrhins ; the remaining species of *Cyprinus prop.* may be formed into a natural group characterised by a long dorsal and the absence of cirri : view the subject as we may, however, *Cyprinus devario*, Buch. is not only different from the true Cyprins, but from the whole of the *Pæonominæ*.

The body is much compressed, narrow, and deep ; the head small, without cirri ; the dorsal and anal long, opposite, and without spines ; the fins feeble, the mouth raised obliquely upwards, and the sides marked each with a broad purple streak, and the abdominal canal, which is continuous with the stomach, is altogether only equal to about the length of the body. For these reasons I regard *Cyprinus devario* as a *Perilampus*, presenting relations of analogy only to *Cyprinus proprius*, as indicated by the arched back and the long dorsal.

The following are the characters by which it may be distinguished,—depth equal to half the length, back arched, dorsal long, sides marked with a single interrupted crooked light blue streak extended over the caudal, jaws rough, with a blunt knob on the apex of the lower jaw, which is narrow and directed upwards. The fin rays are,

D.18 : P.10 : V.8 : A.18 : C.19.

There are about forty scales along the lateral line, which descends along the third row of scales from the ventral margin. Seldom attains more than two inches in length, and is common in Bengal and Assam.

II.—PERILAMPUS OSTREOGRAPHUS, J. M.

t. 45. f. 3.

The depth is almost equal to half the length of the body ; the back is straight from the snout to the caudal, and the lower margin or abdomen is much rounded and protuberant ; the head is small, directed obliquely upward, the body much compressed, and the sides are marked with several

distinct purple stripes extending from the branchial aperture to the extremity of the caudal; the colour of the back is bluish black, and of the abdomen reddish white or pink; the caudal is almost entire, the middle rays being very little shorter than the outer. Fin rays are,

D.12 : P.15 : V.8 : A.16 : C.19.

Thirty-five scales along the sides in depressed oblique rows, and about fifteen from the base of the ventrals to the dorsum. The mouth like the head is directed upwards, and has a prominent knob on the apex of the lower jaw; the tongue is thick and corugated.

The stomach of this fish is about half the length of the body, and terminates in an intestine equal to about the length of the body. The intestine is reflected over upon the stomach, and from thence extends straight to the vent. In the stomach of all those I have examined I found nothing but the remains of insects, such as live on the surface of waters.

The liver extends in a single lobe along the surface of the stomach, to which also the spleen adheres loosely. There is a peculiarity in the air vessel of this species, for instead of being a distinct organ it seems to be either wanting, or merely formed by a duplicature of the lining membrane of the abdomen which forms an air cavity under the spine.

This species is found throughout Assam in small indolent streams, as well as in the larger rivers. It is also abundant in some parts of Bengal, though it is one of the few species that escaped Buchanan's observation. It usually attains about three inches in length, but its great depth and abundance in some places renders it of value as an article of food.

PERILAMPUS ÆQUIPINNATUS,* J. M.

t. 60. f. 1.

For this very well marked species we are indebted to Mr. Griffith's researches in Assam, although it escaped my notice until very recently,

* Etym. *Æqualitas* and *pinna*; in allusion to the dorsal and anal being of equal size.

when engaged replenishing the spirits in which a portion of Mr. Griffith's extensive botanical collections are preserved, during his absence with the army of the Indus.*

The depth of the body is from one-third to one-fourth of the entire length. The pectorals and ventrals are short, the dorsal and anal are of equal size, and the lateral line descends close to the lower margin of the body. The fin rays are,

D.13 : P.13 : V.9 : A.13 : C.19.

There are thirty-two scales along the lateral line, and eight rows from the base of the ventrals to the dorsum. The length of the intestine and stomach together are equal to about the length of the body, inclusive of the head and caudal. The mouth is directed obliquely upwards, with a blunt knob on the apex of the lower jaw, tongue thick and corugated.

IV.—*PERILAMPUS GUTTATUS*, J. M.

t. 45. f. 4. β

Cyprinus laubuca, Buch.

This species was found by Buchanan in the ponds of the north-eastern parts of Bengal. In other parts of the province it would seem to be more rare, as I have only met with one specimen. It is a well proportioned, handsome species, and Buchanan remarks that each nostril consists of but one

* Like several other specimens of fish preserved in spirits along with plants in the same collection, it retains its perfect freshness and form, with a far greater degree of solidity than if it had been kept alone in spirits. This fact may be of some practical use to naturalists with whom it is of course an object to preserve the greatest variety and extent of collections during their travels. It has already been three years in spirits in an Indian climate, and might, to all appearance, keep for ever in the same state; the only disadvantage is that the colour alters to a deep brown or black, but this is removed by subsequent maceration in fresh spirits.

aperture. The usual septum which appears to divide the nostrils of *Cyprinidæ* into two is in this species placed somewhat horizontally so as to form a valve, in which however there is a second aperture.

The head is small, the mouth obliquely raised, the tongue large, and a pointed process is placed on the apex of the upper jaw, with two prominent obtuse points on the lower one; the depth of the body is equal to about a third of the length, the pectorals are long, the ventrals very small, the body inferiorly much compressed, the post-operculum triangular, with a green spot on either side above the base of the pectoral fins. The fin rays are,

$$D.10 : P.12 : V.7 : A.24 : C.\frac{10}{9}.$$

The lateral line descends low along the sides, and beneath it the scales are small, thirty-four in a row on either side, and about seven from the lateral line to the base of the dorsal fin; dorsal and anal opposite.

The stomach and intestine together are scarcely equal to the length of the body.

V.—*PERILAMPUS PERSEUS*, J. M.

t. 48. f. 5.

This species presents all the peculiar characters of the *Perilamps*, in the most prominent degree. The head is small, the back straight from the snout to the caudal, and the mouth may be said to be placed in the upper part of the head so as to be carried along the surface of the water when swimming. The pectorals and ventrals are very long, and each side of the body is marked with a light blue streak. The fin rays are,

$$D.9 : P.18 : V.5 : A.21 : C.—?$$

The caudal is much divided, but the only specimen in my possession is so much injured that I am unable to determine with accuracy the number of scales and caudal fin rays.

VI.—PERILAMPUS PSILOPTEROMUS, J. M.

t. 46. f. 4. β *Cyp. atpur.* Buch. *C. loyukula*, id. Coll.

In this species we perceive a form no less adapted to insectivorous habits than that of the last, but from the great breadth of fin accumulated on the hinder parts of the body or tail, and the oblique insertions of the dorsal and anal fins which bring their propelling power into operation with the caudal in the direction of the long axis of the body, we may conclude that it captures insects rather by sudden springs into the air, than by a rapid course along the surface. Were further proof of this required, we have only to refer to the elongated ventrals which, like stilts, serve to support the vertical position when the anterior parts of the body are emerged from the surface, and to break the fall and preserve the natural balance on returning again into the water.

The body is much compressed, its depth equal to about half its length exclusive of the caudal and head. The mouth is directed obliquely upwards, and the ventral fins are equal to half the length of the body, narrow, and composed of few rays. The abdomen is silvery, and a bright blue line extends along each side from the branchial aperture to the caudal. The fin rays are,

D.9 : P.11 or 12 : V.5 : A.25.

This species grows to about three inches in length, and was found by Buchanan in the Bramaputra, the Ganges, and Jumna.

VII.—CYPRINUS CACHIUS, Buch.

t. 46. f. 6.

Diaphinous with a glossy iridescence changing to green, purple, and silvery on the belly; ventrals slender, and attenuated as in the last. The fin rays are,

D.7 : P.8 : V.3 : A.26 : C.—?

It is found in the Ganges about the commencement of the Delta, and is scarcely an inch in length.

VIII.—*PERILAMPUS RETICULATUS*, J. M.

t. 45. f. 1. β

Cyp. dangila, Buch.

Four cirri; length of the head to that of the body as one to three, exclusive of the head and caudal; depth of the body to the length, as two to five. The sides are ornamented with reticulated narrow blue stripes, below silvery, above olive green, dorsal opposite to the commencement of the anal. The fin rays are,

D.13 : P.12 : V.7 : A.17 : C.20.

The caudal fin is almost entire. I have only seen a single specimen of this fish in Calcutta; according to Buchanan it inhabits rocky streams south of Monghyr, and is said to attain about the size of the finger.

IX.—*PERILAMPUS STRIATUS*, J. M.

t. 46. f. 1. β

Cyprinus rerio, Buch.

A very beautiful little species, found by Buchanan in the Kosi river on the northern boundary of Bengal, but which is also very common in the Sunderbuns, where it seldom attains above an inch in length.

It has four setaceous cirri, two very long and two short, in front of the nostrils. The sides are marked with eight or nine alternate stripes of blue and silver; several distinct blue stripes on the caudal and anal fins; colour above olive, below silvery. The dorsal fin is placed opposite to the

commencement of the anal, and is rounded, the middle rays being longest. The fin rays are,

D.8 : P.9 : V.7 : A.17 : C.18.

The figure, which is from Buchanan's collection, is an excellent representation of this remarkably brilliant species.

X.—*PERILAMPUS RECURVIOSTRIS*, J. M.

t. 46. f. 2. β .

Cyprinus jogia, Buch.

A small species with four fine setaceous cirri, and a dark blue stripe extending from the eye along the middle of each side to the caudal. Length of the head equal to the depth of the body, and one third of the length exclusive of the head and caudal. The jaws are slightly recurved, and the form slender and graceful; the anal small, but placed far back and opposite to the end of the dorsal. The fin rays are,

D.8 : P.10 : V.8 : A.7 : C.19.

Twenty nine scales along the lateral line, and six rows across the body from the ventrals to the dorsum on either side. Found by Buchanan in the Kosi river, but also very common in the Sunderbuns and in ponds at Calcutta. The following is perhaps a variety only,—

XI.—*PERILAMPUS MACROURU*, J. M.

t. 46. f.

Cyprinus sutiha.

A small species with four fine setaceous cirri, two of which are very long. The form is much compressed, the first ray of the fins prolonged to a slender point; the sides are marked with a faint blue silvery line. The fin rays as in the last. This species is found in like manner throughout Bengal.

XII.—PERILAMPUS THERMOPHILUS, J. M.

t. 54. f. 19.

This curious little species was found in hot springs at Pooree by Mr. Cumberland, by whom two specimens were presented to the Medical Society, and afterwards obligingly submitted to me by the Secretary, Dr. Goodeve.

The head is directed obliquely upward, and the tail downward. The caudal fin is however imperfect in both the specimens.

Two short cirri in front of the upper jaw, and two long setaceous bristles at the angles of the mouth; thirty-one scales along the lateral line, and seven rows of scales from the base of the ventrals to the dorsum; chin rounded and placed in front of the mouth. The fin rays are,

$$D.8 : P.9 : V.8 : A.7 : C—?$$

The temperature of the springs in which this species is very common was remarked by Mr. Cumberland to be 112° Faht. but they are said to die when placed in water heated to 120° Faht.

The last three species from the small size of the anal fin should, were we to be guided by that character alone, be placed with the Leuciscs; but the small and obliquely raised head, peculiar form of body, and opposite position of the dorsal and anal fins, are characters which are not to be overlooked.

On the other hand, there are species placed with other genera which might be said to belong to this, as *Cyprinus daniconius* among the Leuciscs, and *Opsarius leucerus*; the first from having the lateral stripes of the Perilamps, and the second from its obliquely raised head; but in *Cyp. daniconius* the dorsal fin is opposite to the ventrals and the head is large, and although *Opsarius leucerus* has the head as well as the habits of a Perilamp, yet it has the elongated and slender form of an *Opsarius*, with the dorsal opposite to the anal, characters which separate it from the Leuciscs.

Remarks on the Genus.

The lengthened rays of the pectoral and ventral fins of *Perilampus perseus*, together with the broad surface of the anal, enable it to move along the surface of the water in pursuit of flies and other insects,—a mode of life for which every part of its structure is admirably formed. The mouth, as already stated, is so constructed as to be carried above the surface, even when other parts of the body are submersed. This essential peculiarity of a species that derives its subsistence exclusively from an element superincumbent to that which it inhabits is effected by means of the lower jaw, which instead of being horizontal, or even slightly inclined, is placed almost vertically in front of the mouth, so that the apex of the jaws are higher than any other part of the body, and diametrically opposite to what obtains in the ground-feeders, or typical *Pæonominæ*, and implies a totally different economy from what belongs to those *Sarcoborinæ* that derive their food from within their own element. In these last, as we shall see in the genus *Opsarius*, or fish-eaters, the mouth is wide, unencumbered with a tongue, and extended straight forward. A tongue indeed to animals that swallow living prey approaching in an incredible degree to their own size, would be an useless appendage. The mouth of the Opsarions is therefore to be regarded as little more than a prehensile apparatus, equivalent to the claws and hands of other animals; but in the fly-catchers, or Perilamps, the mouth is furnished with a large rugose, and we may presume highly sensible, tongue, which is requisite for conveying into the stomach minute objects that would otherwise adhere to the sides of the mouth.

In none of the Barbels, Cirrhins, or Gudgeons, nor in any of those groups that live on plants, shell fish, or other objects obtained by scraping or rooting in mud, do we find any thing like a soft or sensible tongue, the office of which is in many cases better performed by cirri.

Cirri however, when they do occur in the Perilamps, are of that setaceous character which we observe in birds of similar habits, and their use in both cases is the same. But for this unity of design that extends throughout nature, reconciling to certain ends all the infinite variety we behold, we might justly exclaim—How perplexing must the study of nature be, when a single group presents such diversity in form and structure as belongs to the *Cyprinidæ*! A wider view however of those relations of analogy and affinity pointed out by Mr. Macleay dispels all our difficulty, and we find by this means, that a knowledge of one group serves us as the key to every other. After passing through the first section of the Perilamps, the remaining species are furnished with slender setaceous cirri, as already stated, and their low and elongated shapes gradually bring us back again to the ordinary form of *Cyprinidæ*. Their graceful forms, peculiar structure, and brilliancy of colour still however mark them as Perilamps, and certainly give this group an equal claim to beauty in its own circle, with the fly-catchers and butterflies of other classes in theirs. Nor can we altogether say that the dense and gloomy medium to which the Perilamps in common with all fishes are consigned, prevents them from contributing, like corresponding types in other classes, to cheer and enliven the solitary landscape. With fishes we have certainly fewer sympathies, be their beauty what it may, than with beings whose occupations and business of life are carried on before our eyes; but to those whose thoughts are accustomed to dwell on the works of nature, all living beings present something to excite either wonder or admiration. During the stillness of morning, before sun-rise, as well as on the approach of twilight, the Perilamps are almost the only disturbers of our peaceful lakes, and at those hours in particular the surface of ponds is kept in constant ripple by Perilamps in pursuit of insects. Numerous troops of them may also be observed advancing with the tides in the Hoogly and other rivers in Bengal, where they separate into small bands on either side of the current, and spreading with the waters over shallow banks and low inundated tracts covered with vegetation, constitute

with the insects they pursue, and the king-fishers and wading birds which they attract and support, a very lively and interesting part of the scene, to those whose attention has been once directed to the circumstance.

IV.—GEN. LEUCISCUS.

The *Ables*, or white fishes, were distinguished by Klein, a naturalist of the last century, by the following characters—"Dorsal and anal short; neither spines nor cirri, and nothing particular about their lips." Cuvier, however, observes that species with cirri occur, and instances *Cyp. danrica*, Buch., and although I have referred that species to the Perilamps, still I have replaced it by *Cyp. coesa*, Buch., as well as *Cyp. elanga*, id, both of which have cirri. Cuvier in addition to Klein's characters distinguished *Leucisci* into smaller divisions, according to the position of the dorsal fin, which he remarks is not always clear. The genus, he observed, is rich in species; but this is the case with all ill defined groups, it being often as difficult to determine what does not, as what really belongs to them.

LEUCISCUS PROPRIUS, J. M.

Dorsal and anal small, without spines, the last ray of the former placed anteriorly to the first of the latter fin, so as to bring it at least opposite the space between the ventrals and anal, if not opposite to the ventrals. The sides are white and silvery, presenting little variety of colour; the scales are covered with a pearly pigment; the mouth is either horizontal or directed upward; the lower jaw is armed with one or more blunt prominences, or where these are wanting, its apex is received into a fissure in the upper jaw.

The stomach and intestines are scarcely longer than the body, the intermaxillaries are not protractile.

The effect of the foregoing definition, the substance of which may be expressed in a few words, as in the synopsis, is to exclude *Cyp. boga*, Buch. *Cyp. ariza*, id. *Cyp. sophore*, id. and *Cyp. danrica*, id. from this genus, though referred to in the *Regne Animal* as *Leucisci*. The two first are Gudgeons, the third is a *Systomus*, and the fourth is a Perilamp, thus reducing the seven Indian species of this genus indicated by Cuvier to three. But in place of those removed we must add *Cyp. cocsa*, Buch. as its alimentary canal scarcely exceeds the length of the body, while that of the Barbels, with which it stands in the *Regne Animal*, varies from three to six times that length; it is besides without the dorsal spine of the Barbels, while it has faint bars across the body, indicating an approach from the *Leucisci* to the Opsarions. Six other species, most of which I have carefully examined, must also be added, making the number of our Indian *Leucisci* already known amount to ten.

The improvement, if there be any in this restriction of a genus acknowledged before to be imperfect, must rest a good deal on the principle, that nature in fixing the position of the dorsal fin, determines from this, what shall be the concurrent habit and structure of the species.

In looking over the descriptions of the six European *Leuciscs* whose dorsal is opposite to the ventrals, we find the anal small, and the mouth low and horizontal, as if exclusively formed for obtaining their food from the bottoms of waters, and we know this to be further confirmed by the fact of their subsisting chiefly on herbage and worms. We then arrive at Cuvier's second division of this genus, in which the dorsal is placed behind the ventrals. Now, when the dorsal is placed so far behind the ventrals as to be opposite to the anal, I no longer regard the species as *Leuciscs*, but Perilamps or Opsarions, according as they correspond in most respects with one or other of those genera. If we take the Rudd (*L. erythrophthalmus*) as an example, we find it is marked by the receded position of the dorsal, the greater development of the anal, the upturned mouth, and the remarkable brilliancy of colours, all denoting an affinity to the Perilamps; which is further confirmed by a cor-

responding tendency to carnivorous habits; its food being, according to Mr. Yarrell, "worms, molluscous animals, and insects, with some vegetable matter." *Leuciscus alburnus*, another European species, the dorsal of which is placed opposite to the commencement of a large anal, possesses a blind appetite for insects to such a degree as to render it an excellent amusement for young fly-fishers, and the activity of this species in seizing insects is the poetical theme of all field naturalists. This species may also, as well as *Cyprinus cultratus*, Lin., be referred either to the Perilamps or to the Opsarions; but this question I leave to be determined by the naturalists of Europe, where these species are found.

The position of the dorsal and size of the anal therefore become natural characters, and appear sufficient to enable us to discriminate clearly between the Leuciscs and the adjoining groups.

For the right application of these characters, it is necessary to state that we must regard those cases in which the first ray of one fin is opposite to the last ray of the other, and *vice versa*, as opposite fins; and thus we shall very rarely have occasion to remark the position of the dorsal as opposite to the interval between the ventrals and anal, without being more or less opposite to one or other of the latter fins. When such a case happens, the species must be regarded as a Leucisc if the anal be small, and either Opsarion or Perilamp if the anal be large.

Cyprinus daniconius has the form of a Leucisc, with the markings of a Perilamp on the sides. In Buchanan's collection there is a figure of another variety which I have not met with, *Anjana* of the natives, P. G. 328, which in the synopsis I have placed with the Leuciscs under the name of *L. lateralis*, but which we might have equal reasons for placing with the Perilamps. It has in fact the mouth and lateral streaks of the latter genus, with the general form and fins of a Leucisc, so that it would be just as accurate to place it in one genus as in the other. In size and general form it corresponds precisely with *Cyprinus daniconius*, but differs from it in having the head more compressed,

and the jaws recurved directly upwards, with a sharp point on the apex of the lower jaw; both are so nearly allied to each other, and correspond so much with the Leuciscs in the form and disposition of their fins, that we may describe them together in the same genus, although perhaps the true place of the one would be at the close of the Perilamps, and of the other, at the commencement of the Leuciscs.

I.—LEUCISCUS LATERALIS.

Cyprinus anjana, Buch, Coll.

The dorsal is placed opposite the ventrals, anal small; a blue stripe extends from the mouth over the operculum on either side to the caudal. The head is more compressed than the body, the jaws somewhat flattened and directed upwards, with a short point on the apex of the lower one, which is received into a corresponding fissure in the upper jaw. There is a depression on the crown, from which the jaws appear recurved, and this is the only difference in the figure of this species from that given of *Cyprinus daniconius*, P. G. t. 15. f. 89. The fin rays are,

D.9 : P.13 : V.9 : A.7 : C.19.

II.—CYPRINUS DANICONIUS Buch.

P. G. t. 15. f. 89.

The arch of the back descends equally from the base of the dorsal to the apex of the jaws, without a depression at the nape, or on the crown. The head and body are equally compressed, the sides are marked with faint streaks more or less apparent in different specimens, but often obscure and merging to grey and yellow. The mouth is horizontal, and the head placed in a line

with the axis of the body, as in the genus *Leuciscus*, with which it corresponds in the form and disposition of the fins; the rays of which are,

D.9 : P.14 : V.9 : A.8 : C.20.

There are forty scales along the lateral line, and nine rows from the ventrals to the dorsum.

III.—*LEUCISCUS DYSTOMUS*, J. M.

Cyp. elonga. Buch, Op. Cit. 281.

Length of the head to that of the body as one to three, mouth small and directed upwards, with a round knob at the apex of the lower jaw very prominent, two minute cirri are placed at either side of the mouth, opercula slightly pointed behind, suborbital plates a little broader behind than below the eyes; brachial plates projecting slightly over the origin of the pectorals. The fin rays are,

D.9 : P.15 : V.9 : A.7 : C.19.

Forty scales extend along the lateral line, which descends to within four rows of the ventrals, and eleven scales are found in each oblique line from the base of the ventrals to the back. The scales are soft, quite transparent, with a silvery lustre and colour except on the back, where the colour is greenish yellow.

The stomach is small and pyriform, terminating in a short straight intestine; the liver consists of (two?) elongated lobes. The spleen is in this species of considerable size, and of a bright red colour and elongated shape, and is placed between the left lobe of the liver and the stomach. This species, which may be considered to partake equally of the habits of the *Perilamps* and *Opsarions*, is very common in most of the rivers and ponds of Bengal and Assam; its usual size is from six to eight inches in length; its flavor is good, but it is not

so common as to entitle it to any degree of importance, and its habits would render it objectionable in fish ponds. Its food consists chiefly of small fishes and insects, the remains of which have been found in its stomach.

IV.—CYPRINUS RASBORA, Buch.

Op. Cit. Pl. 2. f. 60.

Depth equal to one-fourth of the entire length; body much compressed, and equally arched above and below; mouth directed upwards, with three blunt knobs on the lower jaw; head small; opercula sharp-pointed behind; scales large, about twenty-five along the lateral line, and seven in an oblique row from the base of the ventrals to the dorsum. The fin rays are,

D.9 : P.13 : V.9 : A.8 : C. $\frac{10}{9}$.

Caudal fin tipt with black; body greenish grey above, with a leaden hue on the lateral line; dirty greyish yellow below. This description is taken from a specimen in spirits brought from Upper Assam by Mr. Griffith; the colours are no doubt more marked in fresh or living specimens.

The stomach and intestine taken together are scarcely longer than the body, the abdominal canal is however capacious, and loaded with the remains of insects.

V.—CYPRINUS MOLA, Buch.

Op. Cit. Pl. 38, f. 92.

Moah, of the Assamese.

Scales very small, colour white, opercula rounded behind, and tip of the caudal without any dark colour. The fin rays are,

D.9 : P.15 : V.9 : A.7 : C.19.

Instead of a knob, the apex of the lower jaw is furnished with a sharp recurved edge; the length of the head to that of the body as one to three; the intestine and stomach form a canal nearly twice the length of the body.

The usual size of this species is about four inches, it is very common in ponds and rivers throughout Bengal. There is a small diaphinous variety also very common in Assam, where both kinds are understood by the same name by the natives—*Moah*, said to be derived from the name of an insect on which they feed. In this last variety I found the fin rays to be,

D.8 : P.16 : V.9 : A.6 : C.19.

There is still a third kind, white and silvery like the preceding, with small scales, but more translucent and slender; it is called by the fishermen *Dorikana*. I have named it *L. pellucidus*, but have not obtained sufficient information to notice it separately in this place; its distinguishing characters are noted in the synopsis.

In the preceding species the anal is smaller than the dorsal, and the mouth is directed slightly upwards; but in the following the anal is as large, or larger than the dorsal, and the mouth horizontal.

VI.—CYPRINUS APIATUS. Jacqem.

Voy. Dans l'Ind. t. 15. f. 3.

This species I have not met with, but it is figured in M. Jacquemont's travels in India; and though no description has yet appeared of it, I may add the following note taken from the drawing, which may be sufficient to characterise the species. It appears to have been found in the Jumna.

Depth equal to about half the length, exclusive of the head and caudal, snout and margin of the lower jaw perforated by numerous mucous pores; dorsal and anal contain about nine rays each.

VII.—CYPRINUS CHEDRA, Buch. Coll.

Hardwicke's Illust. t. f.

The most remarkable character of the fish represented by Buchanan under this name, is the contraction of the body between the ventrals and anal, and the recurved direction of the tail, causing a convex, or oblique surface over the insertion of the anal, as in the Barbels. The fin rays, as stated by Buchanan, are,

D.10 : P.14 (?) : V.9 : A.11 : C.18.

There are two circumstances that induce me to suspect the peculiarity in form above noticed to be accidental, or a fault either in the drawing or in the specimen from which it was taken; the first is, that Buchanan does not notice it in his description; and the second, that the fish from which the following description was taken appears to me to be the same species, though differing in the number of rays in some of the fins.

VIII.—LEUCISCUS BRACHIATUS,* J. M.

Pl. 42. f. 5.

Length of the head to that of the body as one to three, and greatest depth is equal to the length of the head; suborbital plates of uniform breadth, scapular and brachial plates present a broad silvery surface behind the opercula; forty-four scales are ranged along the lateral line, which descends to the fourth row of scales from the ventrals; ten scales in an oblique row from the base of the ventrals to the dorsum; at the base of each scale there is a small black spot. The fin rays are,

D.8 : P.14 : V.9 : A.10 : C.18.

* The specimen from which my figure and description were taken, was presented to the Asiatic Society by Mr. Hodgson. I have since however obtained several from Mr. Griffith.

The colour is dark bluish along the back, with a dark streak across the dorsal fin, which with the anal and caudal are tipped with black; the ventrals are small, and rounded. Mr. Griffith states that this species is common in the rapids of the Bramaputra, and most voracious in its appetite for flies.

IX.—LEUCISCUS MORAR,

Cyprinus morar, Buch.

Op. Cit. Pl. 31. f. 75.

Cyprinus bukrangi, id. Coll.

The mouth is small, placed behind a prominent and narrow snout. Back green, sides entirely white, and silvery; scales large and covered with a copious pearly pigment. About forty scales along the lateral line, and nine rows from the base of the ventrals to the dorsum. The lower lobe of the caudal longer than the upper; suborbital plates extend forward to the corners of the mouth; snout fleshy and prominent. The fin rays are,

D.10 : P.15 : V.8 : A.12 : C.20.

This species is very abundant in the Bramaputra, is about three or four inches in length, and as Buchanan justly observes, is high flavoured and much sought after as a delicacy; stomach and intestine form a thick fleshy canal equal to the entire length of the body, inclusive of the head and caudal. In addition to it, Buchanan has figured another variety, *Bukrangi*, in which the lobes of the caudal appear to be less divided, and the scales marked with slight *striæ* in the drawing, and the membrane of the fins dotted, and a slight tinge of yellow on the lower parts of the body. I have not seen this species, nor can I find it described in the Gangetic Fishes.

X.—LEUCISCUS MARGARODES, J. M.

Cyp. jaya, Buch. Coll.?*Chola* of the Assamese.

The mouth is small, placed behind a prominent and narrow snout; scales small, about fifty-four in a row along the lateral line, and eighteen in an oblique line from the ventrals to the dorsum; they are easily detached, and are covered with a copious pearly pigment; lobes of the caudal of equal length; back green, sides silvery, two anterior suborbital plates extend to the upper lip on either side. The fin rays are,

D.9 : P.15 : V.8 : A.9 : C.19.

The stomach and intestine forms a thick capacious fleshy canal, equal to about one and a half lengths of the body, inclusive of the head and caudal. This species resembles *Cyprinus morar* so closely in form that I have not figured it. It is also found in the Bramaputra, especially in Upper Assam.

XI.—CYPRINUS COCSA, Buch.

Op. Cit. Pl. 3. f. 77.

Four cirri; back green; sides, opercula, and lower parts of the body silvery; faint streaks descend partially from the back to the sides, as in the genus *Opsarius*; suborbital plates occupy the space between the eye and the corner of the mouth on either side, as in the last two species; mouth horizontal; forty-two scales along the lateral line, and eleven in an oblique line from the ventrals to the back; snout prominent and deep, with a depression in front of the upper jaw for the reception of the apex of the lower, which is without a prominent tooth. The fin rays are,

D.9 : P.13 : V.9 : A.10 : C.19 :

The stomach is large and muscular, about one-third of the length of the body, with its pyloric reflected and terminating in one large intestine a little longer than the body, or about twice the length of the stomach.

Cuvier has indicated a place for this species among the Barbels, but as we have no instance of Barbels having longer anal than dorsal fins, I have no hesitation in placing it with the Leuciscs, notwithstanding its cirri. In this I am guided equally by its peculiarly bright colours, its short alimentary canal, and comparatively large anal. Its markings however denote an approximation to the Opsarions. I may further remark, that *Cyprinus culbasu*, Buch. *Cyprinus rohita*, id., *Cyprinus gonius*, id., and *Cyprinus daniconius*, id., are also indicated in the Règne Animal as Barbels. The two first are Cirrhins, the third a Labeo, and the last a Leucisc.

XII.—LEUCISCUS ELINGULATUS, J. M

t. 57. f. 4.

The tongue is variously developed in the *Leuciscus*, according as the habits of the species approach to those of the Perilamps, in which it is usually large and rugose ; or to those of the Opsarions, in which it is almost absent ; or to those of *Pæonominæ*, in which it is usually cartilaginous. In this species, however, which is a native of mountain streams at Simla, where it was found by Dr. Macleod, the tongue is almost quite absent.

It was first described in the seventh volume of the Journal of this Society, from a single specimen, as a Perilamp ; but its form though stout and short, is that of a Leucisc. The head and fore part of the body deep ; brachial plates slightly exposed behind the opercula ; snout round, and terminates abruptly in front of the eyes ; forty-six scales are ranged along the lateral line, and eleven in an oblique row from the base of the ventrals to the dorsum ;

colours plain,—at least after having been for a time in spirits. The fin rays are,

D.9 : P.13 : V.9 : A.10 : C.19.

The stomach and intestine form a tube equal to about the length of the body.

V.—GEN. OPSARIUS, J. M.

The body of the Opsarions is either long and slender, or considerably compressed ; the mouth is large, the symphysis of the lower jaw is hard, and received into a fissure in the apex of the upper jaw ; but in the more typical species it is armed with a larger prominence than in others. The back is but slightly raised, but the abdominal margin is more prominent ; the sides are either plain, or marked with transverse green bars or spots. A short dorsal is placed far back upon the body, nearly opposite to a long anal. They are without spines or cirri.

They afford instances of the shortest alimentary canal in the family, and in no case does the entire tube including the stomach, which is usually longer than the intestine, much exceed the length of the body, though it is occasionally much less.

The abdominal cavity is long, and almost entirely occupied with a strong muscular stomach capable of great dilatation, narrowing in its capacity gradually to the pylorus, where it is joined by a short fleshy intestine, which gradually contracts towards the vent. The liver consists of two elongated lobes extending along the stomach ; the air-vessel is very long and narrow, extending the whole length of the abdomen close under the spine, so as to be less exposed to injury during violent struggles in which the species of this genus necessarily engage with their prey. Their habits are extremely voracious and carnivorous, and their whole form constructed for

rapid swimming and sudden efforts essential in procuring prey, which consists chiefly of Gudgeons and other elongated spineless species, which are swallowed entire.

The four first species of the group are white, with long falciform pectorals; the mouth and head obliquely raised with regard to the axis of the body, as in the Perilamps, with which *Cyprinus bacaila*, Buch. and *O. leucurus* agree in habits, living exclusively on insects. *Opsarius pholicephalus* is however a most destructive and voracious fish-eater. The habits of *O. albulus* are as yet unknown, but they no doubt correspond with one or other of the adjoining species. These four are strictly Buchanan's *Chelæ*, and from their compressed and prominent abdominal margin, as well as their form, certainly do evince a relation to the *Clupeæ* as Buchanan supposed; but that this is merely a relation of analogy, we may conclude from the want of *cæcæ*, as well as the hard serrated abdomen, while the head corresponds with that of the Perilamps, and the abdominal canal with that of the Opsarions. Buchanan's name *Chela*, may therefore be retained for them as a sub-genus. The remaining species of the group however are very different; the mouth is horizontal, the head larger and longer, and the body not more compressed than that of the *Salmonidæ*, from which they differ in their shorter and more capacious intestinal canal, which is without *cæcal* appendages, and in the absence of teeth, while their direct affinities confine them to the *Cyprinidæ*, although carnivorous in the very highest degree.

I.—CYPRINUS BACAILA, Buch.

P. G. t. 8. f. 76.

The difference between this species and the variety which I have called *O. leucurus* is very slight, the latter having but two rays less in the anal. All the other characters being nearly the same, I am in some doubt as to the propriety of regarding them as distinct species.

II.—OPSARIUS LEUCERUS, J. M.

t. 47. f. 3.

This is a bright silvery species, very common about Calcutta, with the lower lobe of the caudal longer than the upper. The body above is straight from the apices of the jaws to the caudal fin, the lower margin is gracefully arched from the apex of the lower jaw, so as to form the deepest part of the body under the pectorals, which are long and falciform, and covered above their insertion by a scaly appendix. The fin rays are,

$$D.9 : P.13 : V.9 : A.14 : C.\frac{9}{9}$$

The scales are very minute; the stomach is short, thick, and pyriform, terminating in a short muscular intestine which extends straight to the vent.

Some of the ponds near Calcutta contain vast numbers of this species. After the first fall of rain that took place in June last, when the surface had been parched and dry for several months, I was surprised to see a number of persons fishing in the trenches of the Esplanade, which at first seemed to be quite unconnected with any ponds from which the fish could have come, but on inquiry, I found that they had ascended to the drains from a reservoir at some distance, from which the fish must have had a fall of several feet to surmount.

III.—OPSARIUS PHOLICEPHALUS, J. M.

t. 47. f. 2.

Cyprinus gora, Buch. P. G. p. 263.

Crown covered with scales; minutely serrated and sharp abdominal margin; sides silvery without spots, lateral line descends to the lower third of the abdomen. Pectorals long, ventrals very small. Muscular structure of the

back continuous over the nape to the snout, suborbital plates all of equal breadth, hook or knob on the apex of the lower jaw prominent; dorsal opposite to the ventrals. The fin rays are,

D.9 : P.13 : V.8 : A. 17.

In form this species is not unlike *Opsarius leucerus*.

IV.—OPSARIUS ALBULUS.

t. 48. f. 10.

Cyprinus phulo, Buch. Op. Cit. 262.

Cyprinus phulchela, id. Coll.

A small species found in the ponds in the north-western parts of Bengal; like the last the sides are silvery without spots or bars. The fin rays are,

D.9 : P.11 : V.8 : A.20 : C.18.

Dorsal placed opposite the ventrals.

V.—OPSARIUS CIRRATUS.

t. 56. f. 5. β.

Cyprinus shacra, Buch. Op. Cit. 271.

Head thick, and less compressed than the body. Pectorals low, and situated at a considerable distance behind the branchial aperture. Brachial plates broad, and a flat space below under the base of the pectoral fins; scales very small; suborbital plates of nearly equal breadth behind as below the eyes; rays of the branchial membrane large and strong. Several

short transverse bars on the sides; four cirri; caudal yellow, stained with black; brachial plates exposed and broad. The fin rays are,

D.9 : P.13 : V.9 : A.10 : C.20.

Found by Buchanan in the Kosi river, and in Upper Assam by Captain Hannay; it usually grows to four or five inches in length.

VI.—OPSARIUS FASCIATUS.

t. 48. f. 9.

Cyprinus barna, Buch. Op. Cit. 268.

Cyprinus balibhola, id. Coll.

Depth equal to a third of the length of the body, exclusive of the head and caudal; head deep and compressed, mouth horizontal. Eleven transverse green bands on each side; about forty-two scales along the lateral line; rays of the dorsal widely separated; fins strong, but pellucid. Fin rays are,

D.9 : P.13 : V.9 : A.12 : C.19.

This species has been found by Buchanan in the extreme branches of the Ganges, in the Jumna, as well as in the Bramaputra; it attains three inches in length, he observes, and is often found in shallow waters on sand banks.

VII.—OPSARIUS MACULATUS.

t. 47. f. 4.

Cyprinus tileo, Buch. Op. Cit. 276.

Length of the head to that of the body as one to four, depth of the body equal to a third of the length, sides marked with several rows of green spots, mouth large, lower jaw sharp at the apex, and received into a notch on the

Upper jaw: intermaxillary fixed, suborbital plates broadest below the eyes, brachial plates broad, and extend obliquely backward and downward, terminating in a rounded point on either side over the base of the pectorals. Pectorals and ventrals small, sides silvery, back green, caudal tipt with black, lower lobe longer than the upper. Fin rays are,

$$D.9 : P.14 : V.8 : A.15 : C.\frac{8}{10}.$$

Stomach strong and muscular, intestine consists of a short muscular canal extending straight from the pylorus to the vent.

VIII.—OPSARIUS BRACHIALIS,

t. 48. f. 6.

This is probably only a variety of the last. The suborbital plates are very narrow behind the eyes and broad below, on which account the head is short and deep. The pectoral fins are also placed very low down, and considerably behind the operculum; but the fin rays are nearly the same as those of the last species, and the sides are similarly marked, so that it is doubtful whether the slight diversity of form between the two can be considered of sufficient consequence to render them distinct species. The jaws are narrow, but the gape is wide, and when taken out of the water the jaws are usually much distended.

IX.—CYPRINUS BENDELISIS, Buch.

Jour. Mys. vol. iii. p. 32, P. G. p. 270.

This species though described in both the works of Buchanan above referred to, does not appear to be found in any other part of India than Mysore, unless its place in the Gangetic Fishes be taken as evidence of its being

found in Bengal. It appears to differ from *Opsarius cirratus* in having larger scales, but the markings and fin rays in both are alike, which made me at one time mistake the latter for *Cyprinus bendelisis*.

X.—OPSARIUS GRACILIS, J. M.

t. 47. f. 1.

Cyprinus goha, Buch.

Korang, of the Assamese.

The length of the head to that of the body is as two to five, the body is long and slender, covered by minute scales; the mouth is widely cleft, and horizontal, extending behind the eyes, which are placed in the anterior third of the head. The dorsal fin is placed over the space between the ventrals and anal; the pectorals are of moderate size, the ventrals small. The fin rays are,

D.10: P.13: V.9: A.12: C.18.

One or two irregular bars of round green spots on each side; sides bright, and silvery white; the back is green, and slightly, but uniformly, raised in the middle. The body is moderately compressed, and the dorsal and ventral margins extend uniformly over the head to the apices of the jaws, which are placed in the axis of the vertebral column; the apex of the lower jaw is armed with a prominent blunt knob.

One of the most peculiar characters, perhaps, of this species, consists in the third suborbital plate representing the corresponding bone of the suborbital chain in the Perch, being expanded, and extended backward behind the eye, causing a remarkable elongation of the head, as in some of the Barbels, especially *B. megacephalus*. Yet considering the wide interval between these groups, we cannot look upon this peculiarity otherwise than a relation of analogy, similar to that which the compressed and

smooth abdomen of the two first species of this group presents to the narrow serrated abdominal ridge of the *Clupeidæ*.

The stomach is equal to about half the entire length of the animal, and the intestine from the stomach to the vent only about half the length of the stomach itself, and separated from that organ, which it rivals in capacity, merely by a stricture.

The liver and other large glands whose functions are supposed to facilitate digestion are extremely small in this species, though it is possessed of an insatiable carnivorous appetite; nor have I found in *Cyprinidæ*, in general, those glands bear any proportion to the size of the stomach, or the nature of the food in different species.

This species occurs in all parts of Assam, in the Kosi, the Jumna, the Ganges, and the Soane rivers; in which last Buchanan says it attains the size of a Herring, and is called Trout by the English, chiefly from the spots on the sides, and its fine flavor. For the latter I cannot answer; but as the species of this group are not much esteemed by the natives, I suspect it owes its imagined sweetness, in some degree, to its supposed resemblance to Trout. Notwithstanding the beauty of its appearance, its habits are such as to render it very objectionable in fish ponds.

XI.—OPSARIUS MEGASTOMUS.

t. 48. f. 5.

Cyp. bola, Buch.

Mouth large, several transverse green bars and a yellow longitudinal streak on either side; the suborbital plates are elongated posteriorly; apex of the lower jaw sharp, and received into a notch in that of the upper jaw, which is longer. The fin rays are,

D.10 : P.16 : V.9 : A.11 : C.19.

This species was found by Buchanan in the Bramaputra, where he says it grows to four or five inches in length, and is little valued.

XII.—OPSARIUS ISOCHEILUS.

t. 56. f. 1. β .

Cyp. vagra, Buch. Op. Cit. 269. *Cyp. loya*, id. Coll.

A well formed, handsome species, with a small head; jaws of equal length; intermaxillaries protractile; depth of the body equal to about one-third of its length; the sides are silvery, and marked by a row of small oblong spots placed transversely; the mouth is cleft to the eyes. Fin rays are,

D.9: P.13: V.9: A.14: C.16.

Forty-two scales along the lateral line, and ten in each oblique row from the base of the ventrals to the dorsum. Brachial plates exposed behind the branchial aperture. Found by Buchanan in the Ganges at Patna.

The rays of the caudal being so generally nineteen, I am in some doubt as to their being only sixteen in this species, as observed by Buchanan.

In two small collections of fishes received from very opposite parts of India—Upper Assam and the heights on the Western side of Bengal, for which I have been indebted to the kindness of Captain Hannay and Dr. Macleod—I find a species which, with the exception of having the usual number of caudal rays, differs but slightly from the above.

The following are its characters—forty-four scales along the lateral line, and eleven from the base of the ventrals to the dorsum, nine bars or transverse spots on the back.

D.9: P.12: V.9: A.11: C.19.

HABITAT.—Hazarebaug, and Upper Assam.

XIII.—OPSARIUS ANISOCEILUS.

t. 48. f. 8.

Cyp. barila, Buch.*Cyp. chedrio*, id. Loc. Cit.

Silvery sides, with a row of incomplete bars or oblong transverse spots on each; the deepest part of the body would seem, according to Buchanan's figure, to be about the situation of the pectorals; the head is shorter, and blunter than has been observed in preceding species, and the lower lobe of the caudal is longer than the upper. Buchanan states "the upper jaw is the longest, and is entire at the end," though it would appear to retain the other essential characters of Opsarions. Fin rays are,

D.8 : P.14 : V.8 : A.13 :

This species was found by Buchanan in the northern parts of Bengal; *Cyprinus chedrio*, Buch. would appear to be the same, having one additional ray in the dorsal.

XIV.—OPSARIUS ACANTHOPTERUS, J.M.

t. 48. f. 7.

Balisundree of the Assamese.

The specimen having been lost from my collections before I could make either the necessary corrections of the figure, or of the description, both are to be received with doubt.

Mouth large, suborbital plates broadest beneath the eyes, greenish yellow on the back, with a red blush on the other parts of the body,

sides crossed with green bars, dorsal opposite to the ventrals, contains nine rays and is preceded by a short detached spinous ray ; the first rays of the pectorals separated by a broad expanse of the membrane of the fin.

The alimentary canal of this curious species is long and convoluted in circles round the cavity of the abdomen ; the coats of the stomach and intestines are soft, so as to separate on the slightest touch of the forceps, and the contents are dark coloured ; the air-vessel is long, and divided into two cells, the first small and globular, the posterior cell long, and conical. Although there is something doubtful about the habits of this species which, notwithstanding the length of the intestines is said by the natives to be carnivorous, I have ventured to place it conditionally in this genus.

III.—SUB-FAM.—APALOPTERINÆ, J.M.

This sub-family comprises the Linnæan genus *Cobitis*, the *Pacilia* of Schneider, *Cyprinodons* of Lacepede, and two other small genera recently discovered in India.

They are distinguished as a natural group from preceding sub-families by their slightly compressed bodies covered with a thick slimy mucous, by the uniform softness of all the rays of their fins, and the peculiarities of the head and branchial membrane, as well as by the circumstances attending the air-vessel, which in some is wanting, in others encased in a bony cell, in others divided by a longitudinal septum.

The diversified character of the group may well entitle it to the denomination aberrant, independent of the sense in which that term is strictly employed by writers on natural classification.

Apart from the principles which those writers have laid down, it would be difficult, if not impossible, as indeed it has proved to the greatest comparative anatomist of modern times, to arrange according to their natural relations

the seven artificial genera which he has attached as so many dislocated appendages to a single artificial genus, *Cyprinus*, in the *Regne Animal*.

The length of this paper now compels me to take a rapid survey of the remaining divisions of the family. The first observation that here presents itself, is the very close connexion of the *Pæcilia*, the *Lebias funduli*, and *Cyprinodons*, which in the *Regne Animal* form so many distinct genera, in consequence of a variation in the number of rays in the branchial membrane, while in all other respects they closely correspond. Were the branchial rays alone to direct us in the formation of groups, it is evident the Loaches, which all have agreed to be distinct, should be embodied in one genus with the *Sarcoborinae* and *Pæonominæ*. Since it would be obviously wrong to unite such opposite forms in one group merely because they correspond in the number of branchial rays, it must be equally so to separate other forms which are closely allied because their branchial rays differ. I therefore propose to distinguish all the small groups in question by the following character:—

PÆCILIANÆ.

Head flattened, with minute teeth inserted along the edges of the jaws, caudal entire, from four to six rays in the branchial membrane.

We should then have the following sub-genera forming one natural group:—

- 1 *Pæcilia*, prop. Schn. Five rays in the branchial membrane, jaws protractile, with a single row of teeth.
- 2 *Lebias*, Cuv. Teeth hooked, jaws protractile.
- 3 *Aplocheilus*, J. M. Teeth as in the *Pæcilia*, intermaxillaries fixed.
- 4 *Fundulus*, Lacep. } Four rays in the branchial membrane, teeth crowded.
- and }
5 *Molinesia*, Leseur. }
- 6 *Cyprinodon*, Lacep. Six rays in the branchial membrane.

The first sub-genus is peculiar to the rivers of America, the third is only found in India, and the remainder are common to Europe and America.

The *Platycaræ*, Pl. 49, form the next genus; in these the head is also flat, with the eyes placed on the upper surface, as in the *Siluridæ*; but the mouth is small, without teeth, and soft. The alimentary canal is however short, as in carnivorous species; their pectorals are round, and sometimes placed on fleshy pedicles or arms, with but two rays in the branchial membrane. This remarkable genus corresponds with the natatorial type, to which I conceive the *Pæcilinæ* also belong, notwithstanding their small size.

The *Psilorhynchi* follow the last in the order of their affinities; in these the snout, rather than the head, is flattened, and much elongated in front of the mouth, which is remarkably small. This genus connects the Loaches with the *Platycaræ*, and affords the suctorial type, as will be seen from the descriptions (and figures, Pl. 50) of the only two species yet met with.

To these last the Loaches follow. I have already stated my reasons for having arranged them according to their colours and form of the caudal; I shall now merely notice one or two points on which their typical characters seem to rest. In this group the suborbital plates are transformed into spines, which are fixed by an articulation to a process of the frontal bone in front of the eye, so as to be raised at pleasure as organs of defence, like the horns of Ruminants; at other times these spines are lodged in a suborbital sinus, similar to that of the *Cervidæ*. Of the two sub-genera into which I have divided them, the true Loaches, or those with the caudal entire, appear to be the more terrestrial, in consequence of the rudimental character of the natatory bladder, or, of its total absence in many of the species; while in some of the *Schisturæ*, or those with bifid caudal, there is an abdominal air-vessel enabling the species possessed of it to frequent the deepest waters in the largest rivers, while the true Loaches are generally found in creeks and jeels, and would thus appear to present a closer relation to *Apodal* fishes;

the former therefore close the circle of the family by their union with the Cirrhins. Having thus pointed out the leading divisions of the *Apalopterinae*, I shall now proceed to notice our Indian examples of its component parts in detail.

Of the *Pæcilianæ* we have only in India the

SUB-GEN.—APLOCHEILUS, J. M.

This sub-genus has the head flat and broad, with the eyes placed on its edges, the mouth directed upwards, and a single row of large teeth inserted along the edges of the lips, which are not protractile as in *Pæcilia propria*, Schn. They have five rays in the branchial membrane, the fins thin and transparent, and the caudal entire. A short dorsal is placed near the extremity of the tail and opposite to a long anal ; the ventrals are very small, and the intestine and stomach form together a small tube, scarcely longer than the body. Two species are found in the ponds in Calcutta, and were first pointed out to me by my friend Mr. Griffith, in vessels of water in which he kept *Confervæ* for botanical purposes.

I.—APLOCHEILUS CHRYSOSTIGMUS, J. M.

t. 42. f. 2.

Little more than an inch in length, with a bright gold-like spot on the occiput, and another in front of the dorsal ; about twenty-eight scales along the lateral line, and nine rows between the ventrals and dorsum ; caudal entire, and lanceolate behind. The fin rays are,

D.7 : P.13 : V.—? A.17 : C.18.

The stomach is large, and with the intestine forms a short conical canal about two-thirds of the length of the body.

II.—APLOCHEILUS MELASTIGMUS, J. M.

t. 42. f. 3.

Somewhat less than an inch in length, with a black spot at the root of the dorsal, teeth small, and crowded at the sides of the mouth, with the outer row slightly hooked, caudal entire, and rounded behind. The fin rays are,

D.7 : P.10 : V.—? A.22 : C.18.

Alimentary canal as in the preceding species.

II.—GEN. PLATYCARA, J. M.

BALITORA, *Gray*.

The head is flat, with the eyes placed on its upper surface; the fins are thick, opaque, and supported by soft and feeble rays; the pectorals are large, round, and broad, placed on fleshy pedicles; the anal is small; the dorsal opposite the ventrals; the body long and not compressed; the tail is long and the caudal bifid; mouth soft, small, without teeth, and placed on the lower surface of the head. Three species only are known, and two of these are figured in Hardwicke's Illustrations, but from their forming a distinct type I have taken the liberty of introducing their figures to this paper.

I.—PLATICARA MACULATA.

t. 49. f. 2.

Balitora maculata, Gray, Hard. Illust.

t. 88. f. 8.

Prominent, loose, flacid abdomen, obscure and irregular brown spots on the sides, two small interrupted bars on the caudal, scales rather large, fins except the anal and caudal, round. The fin rays are,

D.8 : P.17 : V.9 : A.6 : C.19.

The stomach and intestine form a continuous fleshy tube not much longer than the body. The specimen from which this description was taken was brought from the Boutan mountains by Mr. Griffith, but was too much decayed to admit of a fuller description.

II.—*PLATYCARA NASUTA*, J. M.

t. 57. f. 2.

This species was found in the Kasyah mountains by Mr. Griffith, to whom we are indebted for so many similar accessions. The snout is abruptly depressed between the eyes, with a large pit between the nostrils; body strong and sub-cylindric; about thirty-four scales along the lateral line, and eight in an oblique row from the base of the ventrals to the dorsum. The fin rays are,

D.10 : P.16 : V.9 : A.6 : C.15.

Length six inches.

Balitora brucei, Gray, Hard. Illust. t. 88. f. 1.

t. 49, f. 1.

Of this species I know no more than is conveyed in the apparently excellent figure given in Hardwicke's plates; it seems to differ from the first in having still broader pectorals and ventrals, and in all the fins being crossed by obscure bars, which might have suggested a more appropriate name than that bestowed on it by Mr. Gray.

III.—GEN. *PSILORHYNCHUS*, J. M.

Muzzle elongated and flattened, eyes placed far back, opercula small, mouth small and suctional, without cirri, fins as in the *Gonorhynchi*, but more elevated.

I am indebted for this genus to two drawings in Buchanan's collection, named by the author *Stolephorus sukati*, and *S. balitora*.

Now the *Stolephore* or *Engraulis*, Cuv. (Anchovies) belong to the *Clupeidæ*, to which the depressed form, and short anals of these species render it impossible that they could belong; and Buchanan seems afterwards to have corrected the mistake, as the species in question appear to me to be described in the Gangetic Fishes as *Cyprinus sucatio*, Buch. and *Cyprinus balitora*, id.

The typical character of these species depends on the extreme prolongation of the snout in front of a remarkably small soft mouth, which is without cirri.

The defenceless body, the backward position of the eyes, the well formed and fully developed fins, indicative of rapid powers of motion, are also analogical relations to the suctorial types of other classes. We are not acquainted with the habits of the species in question, and can only say that they were obtained in the north-eastern parts of Bengal, to which they have been probably swept down from the mountains.*

I.—PSILORHYNCHUS SUCATIO.

t. 50, f. 1.

Cyp. sucatio, Buch. *Gan. Fis.* 347,

Stolephorus sukati, id Coll.

Pectorals round, snout depressed and elongated in front of the mouth, which is small, with fleshy protractile lips; apertures of the gills small, belly flat. The fin rays are,

D.9 : P.13 : V.9 : A.5 : C. 16.

Said to have a strong resemblance to many of the genus *Cobitis* both in form and colour, but wants cirri.

* Since the characters of these interesting species noted in the synopsis were printed, together with other remarks regarding the singular forms of the two species figured by Buchanan, I have been fortunate enough to find a single specimen of one of them in a small collection of fishes with which I have been favoured from Upper Assam by Capt. Hannay.

II.—*PSILORHYNCHUS VARIEGATUS.*

t. 50. f. 2.

Cyp. balitora, Buch. Op. Cit. 348.*Stolephorus balitora*, id. Coll.

The following characters derived from the Assam specimen, differ little from those given by Buchanan, except that the rays of the pectorals are seventeen in each fin, instead of twelve as stated by Buchanan with doubt. The colours are,

Silvery below, above spotted; one row of cloud-like spots along the back, and another on each side; thirty-three scales along the lateral line, and about eight across the body from the base of the ventrals to the dorsum; three bars on the caudal. The fin rays are,

D.10 : P.17 : V.9 : A.7 : C.18.

Stomach hard and round, intestines small, and about half the length of the body.

HABIT.—Rapids at the foot of mountains.

IV.—GEN. COBITIS. Lin.

The Loaches are very numerous in India; Buchanan describes thirteen species, and Mr. Griffith's and my own collection in Assam make us acquainted with seven more.

The caudal fin appears to afford the only natural character by which they may be separated; of this I have taken advantage, and find that in addition to the entire caudal, the colours of the true Loaches consist of different shades between brown and yellow, more rarely green; but whatever the colour may be, it is usually disposed in dots accumulated in clusters or nebulae on the

upper part of the body (Pl. 51 and 52), while the *Schisturæ*, or those with bifid caudal, have their colours, usually different shades of green, disposed in numerous rings or transverse bars distinctly marked on the sides.

In their digestive organs, the true Loaches (*Cobitis prop.*) assimilate nearer than the *Schisturæ* to the preceding genera; the stomach is small, and slightly curved or lunate, so as to place the pyloric orifice in front, and the intestine is either convoluted slightly or straight, according as the stomach may happen to be distended; but the whole length of the alimentary canal does not exceed half that of the body.*

* The observation of Mr. George Daniell communicated to Mr. Yarrell, British Fishes, p. 379, of two spherical bony cavities placed under the first and second vertebræ, seem to me to be nothing more than the bony bilobate case enclosing the air-vessel, as pointed out by Schneider Syn. Pisc. Arted. 5 and 337. Professor Weber, according to Blumenbach, Comp. Anatomy, p. 285, found a connection between the air-vessel and ear of fishes by means of a chain of small bones analogous to the *malleus*, *incus*, and *stapes*, of *Mammalia*. These *ossicula auditus* occupy the situation of the bilobate case in the Loaches. What strengthens the probability of a connection between the air-vessel and ear of fishes, and destroys the idea of the situation of the air-vessel in the Loaches being so peculiar as Mr. Swainson supposes (Nat. Hist. Fishes vol. i. p. 362) is, that it is found in precisely the same situation in several of the *Siluridæ*, according to the interesting observations of Dr. J. Taylor, Gleanings in Science, Calcutta, June 1830. "The air-vessel," says Dr. Taylor of the *Pimelodus gogora*, *P. bagarius*, *Silurus singio*, *Macropteronotus magur*, Buch. "is placed behind the head, close to its articulation with the first vertebra; and in this situation is connected with the *ossicula auditus* which are conspicuous, and present the same appearance as those of the *Silurus boalis*." Dr. Taylor then enters into a very minute anatomical description of the part in question in each of the four species. In the first, it is situated in a bony cup attached by means of a narrow neck to the body of the first vertebra close to its junction with the cranium, and consists of two distinct air-bladders, which have no communication with each other. In the second species the air-vessel is also bilobate, but the lobes are situated on opposite sides of the vertebra. In the two last the air-bladders are also double, consisting of two lobes of pyriform shape, united at their narrow extremities, and continued in a funnel-shaped case projecting outward from the body of the first vertebra. As the direct affinity of the Loaches to *Siluridæ*, is suggested by Mr. Swainson (Nat. Hist. Fishes, vol. i.) without, it would seem, being aware of the singular agreement in the curious points of structure

In the *Schisturæ* the stomach is also lunate, but there is one or two convolutions of the intestine on its surface, and the alimentary canal is somewhat longer, equal to about the length of the body.

M. Agassiz, Mr. J. E. Gray, and Mr. Swainson, have divided the old genus *Cobitis* according to the presence or absence of suborbital spines, retaining the term *Cobitis* for the spineless, and each proposing a separate name for the spined Loaches. I have already observed, that I have sought in vain for other characters that might justify a division so simple and obvious; the result is, that I find it quite untenable, since it separates species otherwise most intimately allied to each other; while, on the contrary, it brings the most opposite forms together. No two species bear a more marked impress of one common genus than *Cobitis oculata*, t. 51, f. 1, and *Cob. pavonacea*, t. 52, f. 1., yet the one has suborbital spines, and the other is without them. No two species look less likely to be members of the same natural group than *Cobitis dario*, Buch. P. G. t. 29, f. 95, and *Cob. cinnamomea*, t. 51, f. 5; yet both have suborbital spines — both would belong to M. Agassiz's genus *Acanthopsis*, to Mr. Gray's genus *Botia*, and to Mr. Swainson's *Canthophrys*, which are all names for the same thing.

alluded to, it is reasonable to suppose that this newly detected relation between *Siluridæ* and *Cobitinae* will be received as confirmation of Mr. Swainson's view, which may be further supported by the form of the air-vessel in those Loaches in which it is membranous, and placed in the abdomen, as *Cobitis dario*, Buch.; for neither in that species, nor in any of the *Siluridæ* which I have examined, is it divided by a stricture as in *Cyprinidæ*,

But notwithstanding the relations here pointed out between the Loaches and *Siluridæ*, the bones of the shoulder, the bones of the head, and the spines, and covering of the body in the two groups, seem to prove that the relations between them are those of analogy, while the absence of teeth, the presence of scales and soft fins, indicate an affinity of the Loaches to the Cyprins, which has induced nearly all authorities on the subject since the time of Artedi to place them contiguous to each other, until Cuvier at length comprised them under one common family.

SUB-GEN.—COBITIS PROPRIA, J. M.

Head and body elongated, the former conical and invested with a thick fleshy covering. Body almost cylindric, with small scales; a clouded distribution of plain colours, often brown; caudal entire, mouth small, placed below a narrow fleshy snout, and surrounded with small cirri. No abdominal air-vessel.

I.—COBITIS OCLATA, J. M.

t. 51. f. 1. β.

Cobitis gongota, Buch.

This species, like most of the Loaches, has six cirri. The eyes are prominent and raised above the crown; pectorals, ventrals, and caudal round; the branchial membrane is attached to the pectoral fins, as in the *Gobes*; body long, and marked with clouded spots of yellowish brown colour; dorsal and caudal crossed with interrupted fine bars or spots; colour above brown, below silvery. The fin rays are,

D.11 : P.10 : V.7 : A.7 : C.16.

Buchanan makes but six rays in each ventral, and eight in the anal fin. It has two suborbital spines on either side; the stomach and intestine are continuous and straight, and about half the entire length of the body. The lower jaw is composed of two very slender bones attached together in front by ligaments, and the air-vessel is contained in a small bony case situated over the entrance to the œsophagus. It is common in small stagnant streams with sandy bottoms in Upper Assam, and Buchanan found it in the northern parts of Bengal near the foot of the mountains; its usual length is about six inches.

II.—COBITIS CUCURA, Buch.

t. 51. f. 2. β .

This beautiful little species, which is named *Chota kukura* by the natives, has also six cirri, and two suborbital spines. The sides are clouded with black along the lateral line, brown above, and below silvery ; all the fins but the anal are rounded, and the eyes are prominent. The fin rays are,

D.9 : P.9 : V.6 : A.7 : C.15.

It appears to be very nearly allied to *C. oculata*. It was found by Buchanan in the northern parts of Bengal, where it attains three inches in length.

III.—COBITIS GUNTEA, Buch.

t. 51. f. 3. β .

This species has two cirri in front of the mouth, and four at its angles ; two suborbital spines on each side, and a nebulous stripe of copper colour extends along the lateral line ; colour above olive, below diaphinous, but clouded with dots collected in clusters, with a tinge of green on the opercula, all the fins except the anal rounded. The fin rays are,

D.8 : P.8 : V.7 : A.7 : C.17.

Rays of the caudal and dorsal spotted with olive, those of the lower fins with dark metallic colour. It is very common throughout Bengal and Assam.

IV.—COBITIS BIMUCRONATA, J. M.

t. 51. f. 5. β .*Cobitis botia*, Buch.

This species has six cirri, with a single suborbital spine on each side. The body is nebulous green above, below silvery, and somewhat diaphinous. The fins are angular, the dorsal and caudal ornamented with spots. The fin rays are,

D.14 : P.13 : V.8 : A.8 : C.15.

This species was found by Buchanan in the rivers in the northern parts of Bengal.

V.—COBITIS CINNAMOMEA, J. M.

t. 51. f. 5. β .*Cob. pangia*, Buch.

This very remarkable species is long, and almost quite cylindric; it has eight cirri with prickles under the eyes, and the whole is a light cinnamon colour; the height of the body is equal to about a tenth of the length; the fins are round and small, the dorsal opposite to the interval between the anal and ventrals. The fin rays are,

D.7 : P.10 : V.6 : A.7 : C.18.

This species was also found in the north-eastern parts of Bengal by Buchanan, who says it attains the length of three or four inches.

The remaining species are without suborbital spines.

VI.—COBITIS OCELLATA, J. M.

t. 51. f. 6. β .*Cobitis biltura*, Buch.

This species has four cirri in front, and two at the angles of the mouth. It has small eye-like spots on the base of the caudal and dorsal fins; colour above brown, disposed in nebulous spots, and bars on the caudal, below silvery; ventrals lanceolate. The fin rays are,

D.14 : P.14 : V.8 : A.7 : C.19.

This species was found by Buchanan in the Bramaputra, and is very nearly allied to the following—

VII.—COBITIS GIBBOSA, J. M.

t. 52. f. 7. β .*Cobitis turio*, Buch.

This species differs very slightly from the last; the back however is more abruptly arched, and the dorsal is much smaller at the base of the caudal; there is an ocellated spot on either side; colour above yellow, with nebulous streaks, below silvery; pectorals and ventrals lanceolate. The fin rays are,

D.8 : P.12 : V.8 : A.7 : C.19.

Two cirri are attached to the corners of the mouth, and four to the upper jaw: found by Buchanan in the Bramaputra.

VIII.—*COBITIS PAVONACEA*, J. M.

t. 52. f. 1.

The body of this interesting species is long, low, and crossed by about twenty half bars of dark greenish grey on the sides, an eye-like spot on either side of the tail, similar to the moons of the peacock, but surrounded by a plain, though distinct colour; caudal and dorsal crossed by numerous bars. There are two cirri at the corners, and four in front of the mouth; the snout is somewhat flattened. The fin rays are,

D.17 : P.13 : V.9 : A.6 : C.20.

The stomach is of lunar form, with the concave margin placed in front, with the pylorus directed forward, and ending in an intestine hardly half the length of the body, and which, after making one short turn passes to the vent.

HABITAT.—Assam.

IX.—*COBITIS CHLOROSOMA*, J. M.

t. 52. f. 3.

Light green, clouded with dark olive green above the lateral line, fins tinged with red, dorsal and anal slightly barred, snout short, six cirri. The fin rays are,

D.11 : P.12 : V.8 : A.6 : C.18.

This species has been found in pools in the sandy beds of rivers in Upper Assam.

X.—COBITIS MONOCERA, J. M.

t. 52. f. 2.

The length of the head to that of the body as one to four, snout somewhat flat, and armed with a slightly prominent spine. The body is uniformly greenish yellow, with a silvery lustre; the integuments covering the opercula tinged with green, caudal and dorsal streaked with numerous small brown bars. The fin rays are,

D.12 : P.12 : V.8 : A.6 : C.18.

The stomach and intestines of this species agree in form with those of *Cobitis oculata*; there is however some uncertainty in judging of the form of the stomach in these species, as I find this to depend partly on the quantity of ingesta contained in it. In a specimen examined after it had been for some time in spirits, the stomach was straight; in others which were examined fresh the pylorus was reflected forward; but in all, the intestine was found to be small and short. This species is not distinguished by the Natives from *Cobitis chlorosoma*, both of which they name *Bali botea*.

XI.—COBITIS GUTTATA, J. M.

t. 52. f. 5. 6.

This species differs from the last two, chiefly in having but four cirri; the snout is soft, and the body dotted, green above and silvery below. There are but eight rays in the dorsal fin. The stomach and intestine form a straight continuous tube. The liver is large, and envelopes the stomach. It inhabits tanks in the vicinity of Joorhath.

XII.—COBITIS PHOXOCHEILA, J. M.

t. 52. f. 4.

This curious species has the head raised obliquely as in the Perilamps, and the ridge between the eyes sharp and bony. Sides compressed, and a dark nebulous streak extends along the lateral line on either side. Above clouded with brown, beneath silvery. The fin rays are,

D.8: P.8: V.6: A.6: C.16.

The caudal is round, and crossed by several small bars. Found by Mr. Griffith in the Mishmee mountains.

SUB-GEN.—SCHISTURA, J. M.

The species composing this sub-genus have hitherto been placed with the Loaches, with which their habits and form correspond; many of them have also similar suborbital spines to those of some of the true Loaches, and all of them have small scales, and the surface of the body enveloped in a copious mucous secretion like the Loaches, from which they are only known by their bifid caudal, and the transverse bars or rings of colour that encircle the body. This last remarkable character may be regarded as a remote analogy to the structure of annulose animals, to which these fishes approximate by means of the Lampreys and Mixines, which Linnæus placed with the worms. The resemblance between the mouth of the Loaches and that of the Mixines is indeed so remarkable as to require only to be alluded to, in order to perceive the relation between the two groups.

The alimentary canal is somewhat longer than the body, the stomach is short and lunate, the pylorus reflected and supplied with a valve. A bilobate natatory bladder, divided by a longitudinal septum, is found in some of the most perfect species, as *Cobitis dario* and *Cobitis geta*, Buch. whose short

figure, arched back, and comparatively lengthened intestine, seem to conduct us back once more to the Cirrhins and other typical forms of the *Pæoninae*. In order that this interesting fact may be conveniently seen by the reader, I have copied Buchanan's figures of the two species in question, Plate 61, f. 8 and 9, for the sake of comparison with the *Ruee*, Pl. 41. f. 2, and other Cirrhins.

It will be evident to the naturalist, or indeed any one who may condescend to reflect on the subject, that we could not consistently commence in this group by describing *Cobitis dario* and *Cobitis geta* immediately after *Cobitis guttata* and *Cobitis phoxocheila*, with which the last group ended, especially if we regard the order in which species are described as that in which their affinities pass from one to another. We must differ therefore in this instance from the usual practice of describing the most perfect species first, and we are compelled, whether we will or not, to commence with the most imperfect form, because it corresponds nearest in every respect with the form last described; and this appears to be a natural result, which must always be experienced in that group which closes a perfect circle of affinities.

I.—SCHISTURA MONTANA, J. M.

t. 57. f. 1.

This small species was discovered by Dr. Macleod in mountain streams in the vicinity of Simla. It is characterised by twelve zones or rings, which encircle the body, and with a black bar at the base of the caudal fin. It is furnished with a single suborbital spine on each side. The fin rays are,

D.8 : P.10 : V.8 : A.6 : C.18.

Dorsal and caudal each marked with a single row of spots; it is one of the most lengthened forms in the group.

II.—SCHISTURA ZONATA, J. M.

t. 53. f. 1.

Without suborbital spines; the body is encircled by about eleven complete rings of green colour; opercula broad, naked, and silvery, fins pellucid, without dots,

D.11 : P.11 : V.8 : A.5 : C.17.

This small species was found in ponds in the Muttuc district in Upper Assam. The pylorus is reflected forward so as to form the stomach into a small lunate sac, on the surface of which two or three convolutions of the intestine take place; between the stomach and intestine there is a narrow stricture, probably a pyloric valve. Limbs of the lower jaw firmly united at the symphysis, as in the Gudgeons.

III.—SCHISTURA RUPECULA, J. M.

t. 57. f. 3.

Without suborbital spines; there are about fourteen bars or zones encircling the body like those of the last; pectorals and ventrals round.

D.8 : P.10 : V.8 : A.7 : C.16.

This species was found by Dr. Macleod in the mountains in the vicinity of Simla, and is very evidently distinct from either of the adjoining species.

IV.—SCHISTURA OCELLATA, J. M.

This is a different species from either of the accompanying, although it is difficult to make the real differences appear correctly either in drawings or descriptions. The fin rays are,

D.9 : P.12 : V.8 : A.6 : C.17.

It was found in stagnant pools in Upper Assam. The stomach is short with the pyloric reflected, intestine small, convoluted over the surface of the stomach, to which the convolutions are closely fixed in this as in several of the *Schisturæ*; the length of the intestine is equal to that of the entire animal.

V.—SCHISTURA SAVONA.

t. 53. f. 3. β .

Cobitis savona, Buch.

Without spines, six cirri, four in front and two at the corners of the mouth, colour above dusky, with about ten narrow light coloured bands; below silvery. The fin rays are,

D.10 : P.10 : ? V.6 : ? A.6.

Found by Buchanan in the Kosi river.

VI.—SCHISTURA PUNCTATA.

t. 53. f. 4. β .

Cobitis corica, Buch.

Without spines; six cirri, four in front and two at the angles of the mouth; a row of eleven spots along the lateral line on each side, and a similar row along the back; below silvery, above bluish; the whole however somewhat diaphanous. The fin rays are, according to Buchanan,

D.9 : P.11 : V.7 : A.6 : C.19.

or, as I have found them,

D.10 : P.11 : V.9 : A.7 : C.10.

VII—SCHISTURA SUBFUSCA.

t. 53. f. 5.

Without spines; four cirri in front of the mouth, various regular zones encircling the body; eyes approximating to each other on either side of a narrow trenchant ridge like that of *Cobitis phoxocheila*; snout hard. Fin rays are,

D.11 : P.11 : V.7 : A.7 : C.17.

HABIT.—Upper Assam.

VIII.—SCHISTURA SCATURIGINA.

t. 53. f. 6. β.

Cobitis scaturigina, Buch.

This species is also without suborbital spines, and in my opinion is nearly allied to *S. subfusca*; the ventrals are however round, and the rays of the dorsal are marked on the middle with a brown spot. I cannot find this species referred to in the Gangetic Fishes, although it is figured in Buchanan's collection.

So many divisions of the Loaches have been proposed, and so many names to designate those divisions, that I feel some doubt in recommending the generic term *Hymenphysa** for the following three species, which are distinguished from all others by the presence of an abdominal natatory bladder, separated into lobes by a longitudinal septum.

* Etym. ὕμεν, a membrane, and φύσα, an air-bladder.

1.—*COBITIS DARIO*, Buch.

t. 61. f. 8. P. G. t. 29. f. 95.

Six cirri, two suborbital spines, body compressed, depth equal to about a third of the length, body crossed by about seven transverse green bands. Three or four interrupted green bands on the caudal. The fin rays are,

$$D.11 : P.13 : V.8 : A.7 : C.\frac{9}{10}.$$

Found in all the large rivers of Assam and Bengal, and attains eight or ten inches in length.

2.—*COBITIS GETA*, Buch.

t. 61. f. 9. P. G. t. 11. f. 96.

Eight cirri, two suborbital spines under each eye, and seven transverse bars of blackish green across the body, and one on either side of the head crossing over the eyes, and also two interrupted bars on the caudal. The fin rays are,

$$D.12 : P.13 : V.8 : A.8 : C.19.$$

Buchanan's variety of this species has but one bar on the caudal, nine rays in each ventral, and only seven in the anal fin. There are other trifling differences of colour between the Assam and Bengal varieties, but scarcely enough to induce me to regard them as distinct species.

3.—*BOTIA GRANDIS*, Gray.*Hardw. Illust—*

Body brown, with irregular and somewhat square yellow spots, fins streaked and spotted with brown, eight cirri. This is the only instance of a spotted species that I know of in this group, and ought to suggest a better name than that above applied to it.

A comparison of the *Schisturæ* as they appear plate 53, with the Loaches which immediately precede them, plate 52, will show that the latter present little resemblance to the typical forms of the great family to which they belong; indeed fig. 7, t. 52. is perhaps the only one on the plate that seems to indicate any resemblance whatever to the ordinary forms of Cyprins.

In the succeeding plate 53, we do see a somewhat nearer approach to the general forms of *Cyprinidæ*; figs. 8 and 9, plate 61, which in their direct affinities follow those species, represented plate 53, present a still closer relation to the Cirrhins, nor is this a mere resemblance of outer form, for in *Cobitis* and *Schistura* the natatory vessel is absent, or enclosed in a bony case which is situated over the throat. But that vessel is again restored to the genus in the two species represented plate 61, thus perfectly obliterating the interval by which the *Schisturæ* at one extremity of the family are removed from the Cirrhins at the other, and causing the two ends to meet, according to the law of natural affinities pointed out by Mr. W. S. Macleay.

DESCRIPTION OF PLATES *LIX, LX, LXI.*

The important use that has been made of the structure of scales of fishes by M. Agassiz, not only in the classification of fishes, but for objects of equal interest in another branch of science, must in future render any descriptions of fishes in which figures of the scales are omitted very incomplete. M. Agassiz in the prospectus of his forthcoming work on the natural history of the fresh water fishes of Europe observes, "Comme j'attache la plus grande importance aux caractères tirés de la forme des écailles, je n'ai point négligé d'en figurer trois pour chaque espèce, savoir, une de la ligne latérale, une de la région dorsale et une troisième de la région abdominale."

Before I was aware of the position and number of the scales selected by M. Agassiz for examination, most of the plates were finished; and to give separate ones of three scales from each species would have increased the bulk and expense of the paper beyond the measure of any equivalent advantage. The scales which are represented on the annexed plates were therefore selected from the posterior third of the body, about half way between the dorsal and caudal fins, where they appeared to bear the nearest relation to the general form of scales on other parts of the body. When a second scale is given, it has always been taken from between that situation and the dorsum.

PLATE LIX.

- Fig. 1. Scale of *Leuciscus daniconius*, Buch. from the lateral line.
- Fig. 2. Scale of *Leuciscus dystomus*, J. M. from the lateral line.
- Fig. 3. Scale of *Leuciscus morar*, Buch. from the lateral line.
- Fig. 4. A single scale of *Opsarius leucurus*, from the lateral line.
- Fig. 5. Scales of *Leuciscus mola*, *a* from the lateral line, *b* from between that situation and the back, *c* natural size.
- Fig. 6. A single scale of *Cyprinus baicala*, Buch.—*b* natural size.
- Fig. 7. A single scale of *Leuciscus margarodes*—*b* natural size.
- Fig. 8. Scales of *Leuciscus elingulatus*—*a* from the lateral line, *b* from between that situation and the back.
- Fig. 9. Scales of *Opsarius fasciatus*—*a* from the lateral line, *b* from between that situation and the back.

- Fig. 10. Scales of *Opsarius megacephalus*—*a* from the lateral line, *b* from between that situation and the back.
- Fig. 11. A single scale taken from the lateral line of *Opsarius maculosus*.
- Fig. 12. A single scale from the lateral line of *Opsarius brachialis*.
- Fig. 13. Scales of *Opsarius isocheilus*—*a* from lateral line, *b* from between that situation and the back.
- Fig. 14. Scales of *Opsarius cirratus*—*a* from the lateral line, and *b* from between that situation and the back.

PLATE LX.

- Fig. 1. *Perilampus æquipinnatus*, J. M. natural size—*a* breadth of the body, *b* scale from the posterior third of the side a little above the lateral line which is very small.

The remaining figures of scales on this and the succeeding plate have been drawn from the microscope by my friend Mr. W. M. Westermann.

- Fig. 2. Scales of *Cyprinus curchius*, Buch—*a* from the lateral line, *b* from between that situation and the dorsum, *c* and *d* natural size.
- Fig. 3. Scales of *Gobio bicolor*, J. M.—*a* from the lateral line, *b* from between that situation and the dorsum, *c* and *d* their natural size, *e* the manner in which they are placed.
- Fig. 4. Scales of *Gobio anisurus*, J. M.—*a* from the lateral line, *b* from between that situation and the dorsum, *c* and *d* natural size, *e* their disposition.

Fig. 5. Scales of *Gobio isurus*, J. M.—*a* from the lateral line, *b* from between that situation and the dorsum, *c* and *d* natural size.

Fig. 6. Scales of *Gobio ricnorhynchus*, J. M.—*a* from the lateral line, *b* from between that situation and the dorsum, *c* and *d* natural size, *e* the manner in which they are placed.

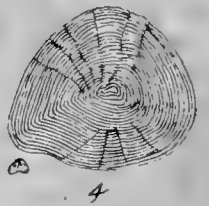
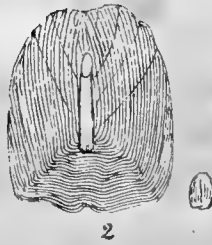
Fig. 7. Scales of *Gobio limnophilus*, J. M.—*a* from the lateral line, *b* from between that situation and the dorsum, *c* and *d* natural size, *e* the manner in which they are placed. In this species, as already remarked in the description, every row of scales has its own row of mucous pores the same as the lateral line, which last differs from the other rows merely in being a little more prominent.

Fig. 8. Scales of *Cyprinus boga*, Buch.—*b* from the lateral line, *a* from between that situation and the dorsum, *c* and *d* natural size, *e* their relative position to each other. In this species, which may either be *Cyprinus boga*, *Cyprinus ariza*, or *Cyprinus pangusia*, of Buchanan, each row of scales is possessed of a line of mucous pores as in *Gobio limnophilus*.

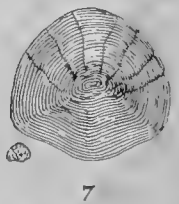
Fig. 9. Scales of *Gonorhynchus macrosomus*, J. M.—*a* from the lateral line, *b* from between that situation and the dorsum, *c* and *d* natural size.

Fig. 10. Scales of *Gonorhynchus bimaculatus*, J. M.—*a* from the lateral line, *b* from between that situation and the dorsum, *c* and *d* natural size.

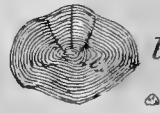
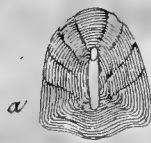
Fig. 11. Scales of *Gonorhynchus brachypterus*, J. M.—*a* from the lateral line, *b* from between that situation and the dorsum.



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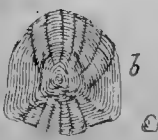
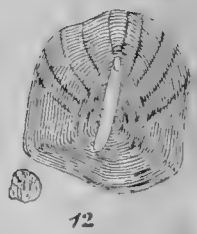
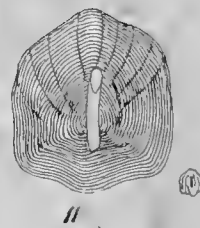
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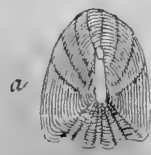
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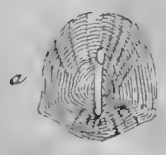
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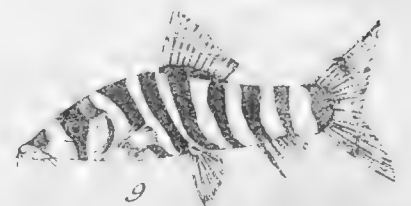
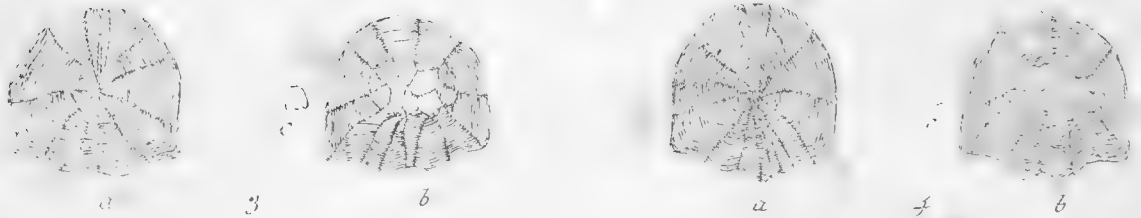
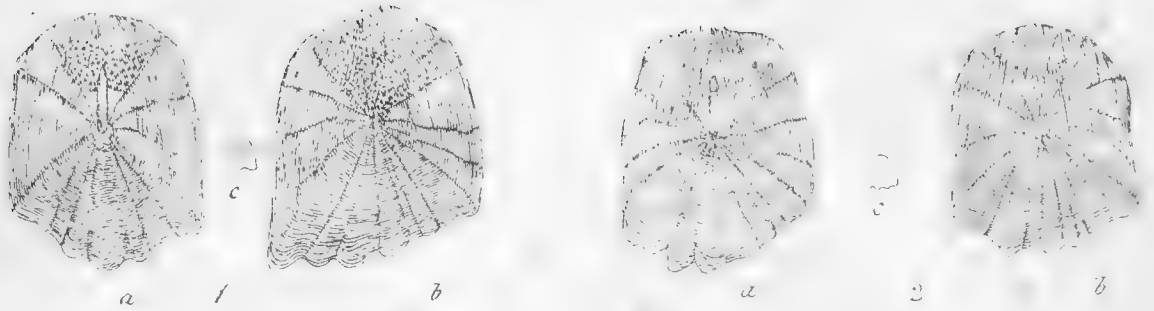
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PLATE LXI.

- Fig. 1. Scales of *Systomus chrysosomus*, J. M.—*a* from the lateral line, *b* from the interval between that situation and the dorsum, *c* natural size.
- Fig. 2. Scales of *Systomus immaculatus*, J. M.—*a* from the lateral line, *b* from between that situation and the dorsum, *c* natural size.
- Fig. 3. Scales of *Cyprinus sophore*, Buch.—*a* from the lateral line, *b* from between that situation and the dorsum, *c* natural size.
- Fig. 4. Scales of *Systomus pyropterus*, J. M.—*a* from the lateral line, and *b* from between that situation and the dorsum, *c* natural size.
- Fig. 5. Scales of *Cyprinus conchoniis*, Buch. In this species the lateral line is very obscure, or altogether wanting;—*a* is a scale from the usual place of the lateral line, and *b* from between that situation and the dorsum, *c* natural size.
- Fig. 6. Scales of *Systomus malacopterus*, J. M. The lateral line in this species is also indistinct;—*a* is a scale taken from its usual position, *b* from between the usual position of the lateral line and the dorsum, *c* natural size.
- Fig. 7. A scale from the lateral line of *Oreinus progastus*, J. M.
- Fig. 8. *Cobitis dario*, Buch. Natural size, and,—
- Fig. 9. *Cobitis geta*, Buch. two species here introduced from the Gangetic Fishes, to show how the form of the Loaches returns to that of the Cirrhins. Thus they may be compared with f. 1. t. 37., fs. 1. 2. t. 38., fs. 1. 2. 3. t. 40., f. 2. t. 41.

It remains to express my obligations to those who have assisted the object of the foregoing paper.

To WILLIAM GRIFFITH, Esq., M. A. S. &c. Madras Medical Service, who aided me in my collections since 1835, and is still mindful of this though engaged in other services of higher interest to science, I have been indebted for many species hitherto unknown from countries only visited by himself, and which were preserved under difficulties and privations that would have deterred an ordinary naturalist from the attempt, especially in the midst of other occupations.

To B. H. HODGSON, Esq. M. A. S. &c. Resident at Nipal, I have been indebted for a small collection of Cyprins deposited in the Asiatic Society ; and to W. M. WESTERMANN, Junior, Esq.—a name not unknown to science in connection with one of the richest cabinets of insects in Europe, am I indebted for the drawings of scales forming the last two plates.

To Doctor MACLEOD, Inspector-General of Her Majesty's Hospitals in Bengal, I have been indebted for several collections from different parts of India, comprising many species previously unknown.

To Capt. SIMON FRASER HANNAY, I am indebted for several species from Assam, some of which had escaped me during my visit to that province, as well as for others which were lost from my own collections from the difficulty of preserving them in this climate.

I am also indebted to Captain FRANCIS JENKINS, M. A. S. &c. Commissioner of Assam, for similar favours, as well as for other facilities afforded to my pursuits.

To Captain RICHARD LLOYD, M. A. S. Indian Navy, who had already rendered a high service to ichthyology by the facilities afforded to Dr. Cantor while under his command, I am indebted for several small collections of fishes from the Tenasserim coast.

To R. B. CUMBERLAND, Esq. Bengal Medical Service, I am also indebted for a small collection of fishes from the Cuttack district : and, lastly—

I am indebted to the gracious consideration of the RIGHT HONORABLE GEORGE, LORD AUCKLAND, G. C. B. &c. not only for the opportunity of examining my collections of fishes, which had otherwise been denied on my return from Assam, but also for the inspection of the splendid collection of drawings of the late Dr. FRANCIS BUCHANAN HAMILTON, many of which, under Providence, I have been the humble means of submitting to the world.

SUPPLEMENT.

Since this paper was presented, two important communications have been made in Europe on the subject of the Fresh-water Fishes of India. The first is a paper presented in December, 1838, to the Zoological Society of London by Colonel Sykes, descriptive of forty species inhabiting the rivers of the Deckan, including several new genera. As Colonel Sykes's paper has not yet appeared, it remains to be seen how far the fishes of Western India correspond with those of the Ganges, Bramaputra, and North-eastern tributaries of those rivers, from which nearly all Buchanan's species and my own have been derived. The second work just alluded to, embraces descriptions of sixteen species of fishes found by Baron Hügel near the source of the northern branches of the Indus, of which fifteen belong to the great natural family *Cyprinidæ*; these are all ably described and beautifully illustrated by M. von Heckel, an eminent German naturalist of Vienna,* who anticipates some of the observations contained in the foregoing pages, as well as one new genus, *Oreinus*, of which M. v. Heckel describes ten species, all except one distinct from the three which I have met with. The curious circumstance of the absence of *Salmonidæ* in

* Fische aus Caschmir, gesammelt und herausgegeben Von C. F. v. Hügel, beschrieben Von J. J. von Heckel, &c. &c. Wien, 1838.

India, which I have observed upon, p. 262, also seems to have occurred to M. M. Hügel and Heckel, who observe that the *Cyprinidæ* have not only replaced the *Salmonidæ* in the rivers of India, but have also assumed much of their habits. In the Nile, they observe, we have few Cyprins, and in the rivers of Surinam and Brazils there are none; it is only in the rivers of India where Cyprins have replaced the Trouts, (*Forellen*) that the number of their species is so considerable (Fische aus Caschmir, p. 2.). The species described in the work alluded to as *Silurus lamyghur*, Heck. differs from *Silurus pabda*, Buch. in the eyes being nearer to the mouth; but in other respects it approaches, M. v. Heckel thinks, to *Silurus chinensis*, Lacep.; the colour is rusty brown, with a silvery glitter. The next two are Loaches, not far removed from the species I have described as *Cob. chlorosoma* and *Cob. guttata*. They are named by M. v. Heckel *Cob. marmorata*, and *Cob. vittata*. The first, he thinks, may be *Cobitis corica*, Buch. and the second is named *Gurua*, by the natives of Cashmeer. A fourth species described by M. v. Heckel is referred to the genus *Varicorhinus*, Rüppell, which would include those species I have described as Gudgeons when they happen to have two cirri; but as cirri are not characters to be alone relied on in the formation of groups, it is unnecessary to dwell on the value of this genus: those who wish to adopt it, have only to apply the term *Varicorhinus* to the five first species of *Gobio* I have described, namely, the *Mrigala*, the *Rewah*, *Curmuca*, *Reba*, and *Angra*. The one described by Heckel as *Varicorhinus diplostomus*, Fisch. Casch. t. xi., is a new species, somewhat resembling, as M. v. Heckel supposes, *Leuciscus doubtla*, but the body is more cylindric, and less compressed than any previously known species either of India or Europe.

The sixth species of M. v. Heckel is referred to another nominal genus, *Labeobarbus*, Rüppell, which differs in nothing more from the genus *Barbus*, Cuv. than in a fleshy appendage to the apex of the lower jaw, as in *Barbus progeneius*, J. M. t. 56. f. 3. The species given by Heckel as *Labeobarbus*

macrolepis, o. c. t. x. f. 2. appears to resemble very much a species figured in Buchanan's collection under the name of *Cyprinus tor*, which is however, according to Buchanan, a large fish, while Heckel's species is only five inches long. I now come to M. Heckel's new genus *Schizothorax*, Etym. Σχιζω split (*spalten*) θωραξ a shield (*panzer*), from a membranous gusset in front of the anal fin, thus separating the scales slightly on either side of the vent; a character which I have overlooked in my genus *Oreinus*. I regard this curious peculiarity as an indication of some remarkable function or analogy. When in addition to this singular structure the scales on either side of the anal are enlarged, as in all M. v. Heckel's species, the character may be conspicuous enough; but in the three species I have met with, the scales, as in most *Cyprinidæ*, continue to diminish progressively from the sides to the hinder part of the body, where they are smallest; the membranous cleft however is perceptible; I would therefore regard those species whose scales are not enlarged on either side of the anal cleft, as still belonging to the sub-genus *Oreinus*, especially as M. v. Heckel observes with regard to *Cyprinus Richardsonii*, Gray, which I had ranked with the latter group, that it agrees nearly with his *Schizothorax plagiosomus*, but as the great scales near the anal appear from the figure to be wanting, it cannot be included in that genus (see note, Fisch. Casch. p. 16). Instead of the sub-genus *Oreinus* being ranked under the head of the Barbels of Cuvier, as it stands in the preceding pages, it should now become a sub-genus of M. v. Heckel's new group, of which the following are the characters:—

SCHIZOTHORAX, Heckel.

Four cirri, one at each angle of the mouth and two at the middle of the maxillary bones; dorsal and anal short, the first preceded by a bony ray serrated behind; scales small; the latter part of the belly terminating in a membranous space, in which the vent is placed, bounded laterally by large scales, which also encircle the base of the anal fin.

Ten species of this genus are described by M. von Heckel, all of them found by Baron Hügel in the tributaries of the Hydaspes; M. v. Heckel forms them into three divisions, according to the structure and situation of the mouth and snout; but as these peculiarities, together with the dorsal spine, form their great distinguishing feature from all previously known groups, they ought perhaps to have been stated in the essential characters of the genus, particularly as the species do not differ so much among themselves as to render the subdivisions proposed by M. v. Heckel of much consequence.

To enable the reader to identify the several species described by M. v. Heckel, I here subjoin a synopsis of them :—

1. *Schizothorax plagiostomus*, Heck. Fisc. Casch.t. i. Snout blunt and wrinkled, mouth inferior, large and transverse; cheeks and snout perforated with numerous pores. Length $8\frac{1}{2}$ inches.

2. *Schizothorax sinuatus*, id. o. c. t. ii. Head compressed and obtuse, mouth small, dorsal placed over the commencement of the ventrals; body spotted uniformly above the lateral line, below silvery. Length 8 inches.

3. *Schizothorax curvifrons*. id. o. c. t. iii. Snout placed in a line with the axis of the body, crown rounded prominently over the eyes; back spotted, as well as the dorsal fin. Length $8\frac{1}{2}$ inches.

4. *Schizothorax longipinnis*, id. o. c. t. iv. Snout blunt, compressed and deep, corresponding with the axis of the body; anal fin long; body without spots. Length $9\frac{1}{2}$ inches.

5. *Schizothorax niger*, id. o. c. t. v. Snout short, head depressed over the eyes, sides and dorsal uniformly spotted and dark. Length 9 inches.

6. *Schizothorax nasus*, id. o. c. t. vi. Snout below the axis of the body, back rather abruptly arched in front of the dorsal fin; back and base of the dorsal fin spotted. Length $10\frac{1}{2}$ inches.

7. *Schizothorax Hügelii*, id. o. c. t. vii. Snout below the axis of the body, thick. Dorsal fin commences in the middle of the back, scales at the base of the anal fin very large; spotted along the back. Length 14 inches.

8. *Schizothorax micropogon*, id. o. c. t. viii. f. 1. Snout in the axis of the body, cirri very small, mouth small. Length 5 inches.

9. *Schizothorax planifrons*, id. o. c. t. viii. f. 2. Snout above the axis of the body, and somewhat recurved, crown depressed, cirri longer than in the others.

10. *Schizothorax esocinus*, id. o. c. t. ix. Snout placed in the axis of the body, head long, depressed; operculum terminates behind in a long angular process; mouth long, as in the ordinary Barbels, spots dispersed irregularly on the sides above the lateral line and on the base of the dorsal and anal fins.

This last form approaches to the true Barbels, and the succeeding species described by M. v. Heckel as *Barbus diplochilus*, t. x. f. 1. is either an *Oreinus* or a *Gonorhynchus*.

It would really seem as if we intended to leave all that requires either intellect or observation to discover in the productions of India to our neighbours on the continent. It is true, Natural History is not a pursuit likely to enrich the individuals who follow it; but as calculated to direct the energies of a nation to practical objects, as well as to afford the best promise of new articles either for our luxuries or our wants, its claims are not to be despised.* To be fairly rivalled in any pursuits where facilities

* It is not an uncommon thing with us, to witness the publication of journals, reports, travels, and books of various kinds devoted to new countries, without a single remark to show that the author of any of them seemed at all aware that the creation consists of any thing deserving of observation but himself and his kind. However excusable this may be in the mere tourist, it is hardly so in those who are supposed to have been selected for their presumed acquirements as Naturalists.

While we are thus indifferent to objects that should connect our names with the science of our country, the collections of M. Jacquemont, M. A. De Lessert, M. Von Hügel, and other distinguished foreigners are daily appearing, some under the auspices of Societies abroad, and others under that of foreign noblemen who devote their wealth to the promotion of science; so that, however the sciences of Europe may be expressed in the English language, those of India are likely to be found only in languages foreign to the English student. The Indian Education Committee, at whose door Buchanan's MSS. have so long lain, while ten thousand pounds a year have been expended by them in juvenile schools, should look to the situation to which they are soon likely to be reduced.

[The attempt

are equal between the parties would be bad enough, but to be indebted to strangers for a knowledge of the productions of our own country, argues a fault somewhere, but where that fault lies it might be a delicate question to inquire, as I fear none of us would be altogether free from a share of the reproach. As far as *Cyprinidæ* are concerned, the preceding pages will afford any one an opportunity of comparing those which are here described with such as occur in his vicinity, and by thus endeavouring to complete the history of each species, we might soon become as well acquainted with Indian, as with European kinds.

The attempt to carry a national system of education into effect by means of juvenile instruction, while the cultivation of those sciences on which national prosperity depends is neglected, as well as individuals who evince a capacity and desire for education, may be regarded as doubtful in every way. Children can hardly be made the objects of foreign education without exciting the jealousy of parents, which has a secret tendency in the opposite direction; besides, few profit by instruction received in childhood. For these reasons, I think, attempts ought to be directed to the extension of science, and to the instruction of those only who evince a desire and capacity for it. In plans conducted on such principles we could hear of no failures, every rupee laid out would have its effects, and leave something to show for it.

In France we have heard of education being superintended by Cuvier and the greatest members of the Institute, but in England we search in vain for the names of our philosophers in Kildare Street and British School Societies. Hence their failure; for who are so fit to direct the education of others, as those who have themselves displayed the highest proofs of cultivated genius. Although it would unquestionably be a loss to the world were our Herschels, Browns, Daltons, and Macleays to devote their attention to other objects than their own researches, yet their presence in the places alluded to, would inspire a confidence that must be wanting in any system of education emanating from bodies from which they are excluded.

On the use of Ichthyology.

Utility will always be found to depend more on the degree of attention paid to any subject connected with science, than on the nature of the subject itself ; yet it is a common remark that this, or that, is important or frivolous, according as we happen to be acquainted with it. When we find any branch of science regarded as useless, we may be assured that, contrary to ordinary expectation, it will prove the most productive field we can enter. Science, indeed, can only be useful where it has been cultivated, and its principles worked out ; practical results will then follow in proportion to the pains taken to develop them.

The moral interest of Ichthyology having been sufficiently attended to throughout the preceding paper, I shall here pass it over, merely remarking, that in common with other branches of natural science it is calculated to improve the mind as well as the condition of society, while its cultivation need not interfere with any duty, public or private ; and few who are placed on our coasts, or on the banks of any of the noble rivers of India, who might not with amusement to themselves, and advantage to science, communicate many observations no where else to be collected regarding our indigenous species. The season of spawning, and places to which the various species resort for this purpose—their food—the kind of waters in which they thrive best—whether running or stagnant—with sandy or with muddy bottoms,—would be all points of great interest that might be settled by persons of no pretensions to a scientific knowledge of the subject.

With regard to the propagation of fishes, Mr. Yarrell remarks—that an acre of water will let in many parts of the continent where fresh-water fishes are in more request than in England, for more than an acre of land. In no part of the continent of Europe, however, can fresh-water fish be of so much im-

portance as in India, where most of the domestic animals which in Europe afford the principal food, as the ox, swine, poultry, &c. are rejected by a large proportion of the people.

Throughout the Mysore country, as well as in many of the western provinces, large tanks or reservoirs occur, many of them from three to thirty miles in circumference, and being indispensable for irrigation, may be supposed to be nearly universal in all populous districts not watered by rivers. These reservoirs are considered by the Hon'ble Colonel Morison C. B.* as among the greatest national monuments to be found in India

They are capable, according to Buchanan,† of supplying water for from eighteen months to two years, and thus of maintaining the surrounding crops should no rain fall within that period.

They are drained by an ingenious system of sluices and aqueducts of the most simple, but complete construction, which afford a perfect control over the distribution of the water. During the dry season they are all pretty much exhausted, and may, if necessary for repairs, be left perfectly dry. This would afford an excellent opportunity for destroying crocodiles and all the various destructive fishes, sparing only the more profitable kinds, which are limited to two or three species only ; and by repeating this operation for several seasons, or as often as may be necessary, all but those we wish to propagate would soon be exterminated.

By a wise law of nature, the carnivorous animals of every class are less prolific than the harmless, and may therefore be the more easily subdued. Nearly all the destructive fishes are viviparous, bringing forth comparatively few young ; whereas, the more profitable kinds, or those which should be the object of our care, are all oviparous, and bring forth their young from spawn.

* To whom I am indebted for many particulars regarding them.

† See his Journey in Mysore.

A single female Carp weighing only nine pounds has been found by Bloch to contain no less than six hundred thousand ova ; and by Schneider, one, ten pounds weight, was found to contain seven hundred thousand ova, or eggs.

The fecundity of the *Ruee*, *Catla*, and *Mrigala*, has not yet been ascertained, but from their close affinity to the Carp we may suppose them to correspond in this respect with that species ; the question, however, is one that may be easily ascertained by weighing a grain of the roe and ascertaining the number of globules it contains, while these will be to the whole roe what one grain is to its entire weight. The result will show that these species are capable of yielding, by their extraordinary fertility, a source of food as inexhaustible as the sands of the ocean, could we only bring their propagation and the safety of the young sufficiently within our control.

In the reservoirs above described, we have every facility for effecting this object on a scale of great magnitude, without in any way interfering with the other uses of the water.

There are certain kinds which though they cannot be said to be carnivorous, would yet be still more fatal to our object by devouring the spawn or ova ; such are the Barbels, so common in the higher parts of our rivers, and which but for a knowledge of this trait in their character would, from their appearance and flavour, be the first we should recommend for propagation, and thus from an ignorance of one simple fact, destroy every chance of success. We should not, however, condemn all the Barbels merely from a fault in some of the species, the circumstance should impress on our minds the necessity of confining the varieties of fish in a single reservoir to the lowest possible number of herbivorous kinds, such as the three I have mentioned, namely, *Cyprinus rohita*, Buch. *Cyprinus catla*, id. and *Cyprinus mrigala*, id. ; there is reason to believe that either of these species would answer equally well in any part of the plains of India. As they usually attain a large size, they may be slow in coming to perfection, and, therefore, instead of having these three large spe-

cies in the same water, it would probably answer the purpose better to have one of them only as a principal species, with any one of the common Gudgeons or Bangons of India as a cheaper article, which would not require more than a year or two at the utmost to arrive at perfection. Beyond a single species of *Gobio*, and a single one of the larger species already mentioned, more ought not to be introduced to the same water, or allowed to exist in it, from the danger of their proving inimical to each other, a point which I presume has never been attended to sufficiently in attempts hitherto made to propagate fishes; hence, perhaps, the want of that degree of success which no doubt would have rendered a practice so simple and beneficial, long since universal.

The only alteration in the present form of the reservoirs to adapt them to the purposes in view, would be to enclose the lowest portions of the bottom of each with stakes, long enough to reach above the highest surface of the water, and close enough together to prevent the entrance of crocodiles, otters, and the like, should any such exist in the neighborhood. The spawning season of the *Ruee* and other *Cirrhins*, appears to be in the dry weather; the contrivance here suggested would therefore protect them at that time, and if there should be any danger of the whole of the water drying up, wells of sufficient size and depth might be formed within the enclosure, to which the fishes would retire during droughts, while the shallow waters around the wells would afford space enough for the deposit of spawn.

Much of our success would depend on keeping these enclosures as free as possible from all but the species we desire to propagate. At the commencement of the dry season, before the fish begin to enter the enclosure, the interval between the stakes might be closed with straw, and as the water becomes sufficiently low without, most of the rapacious kinds may be removed or destroyed; none should be allowed to remain, but that species alone which may be the object of our care. This done, the only further attention necessary, would be to save the fish in the enclosure from birds during the remainder of the dry season.

Should our success be complete, from every moderately sized female *Ruee* we should have on the commencement of the rains from five to ten hundred thousand fry, which, as the waters rise would be quite able to take care of themselves till the next season, when it would be necessary again to destroy the rapacious kinds, as before.

The repair of the *carays** of Mysore is said, by Buchanan, to be attended with considerable expense, nevertheless it is understood to be an indispensable object to have them in perfect repair, since the fertility of the country depends entirely on them. The plan here proposed of converting them to new purposes of utility would add to their importance, and the interest of keeping them up, without in any way increasing their expense.

On the fishes of Bengal, Assam, and other provinces subject to the inundations of the larger rivers, we can exercise no control, nor is it desirable that we should, even if it were in our power, the supply of fish being plentiful and constant enough ; but in the higher parts of the plains, near the foot of the mountains where the larger Cirrhins and Barbels retire during the dry season for the purpose of spawning, fisheries might be carried on with advantage to a considerable extent. See p. 339.

It would here be out of place to enter on the subject of sea fisheries, and before we could do so with advantage it would be necessary to pay as much attention, or more, to the fishes of our coasts as we have devoted to those of our rivers.

Already we have attained one important piece of information regarding the value of the *Sulea* fish of our estuaries, *Polynemus sele*, Buch., which from the earliest times has been celebrated throughout China for its isinglass. This substance was formerly supposed to be afforded only by certain fishes in the rivers of Muscovy, from whence it was exported to all parts of Europe, where, from its high price, its use is chiefly confined to the arts.

* Such is the name by which the reservoirs are known in Southern India when kept up for irrigation.

A solution of this substance mixed with Canadian balsam and spread on black silk forms the useful article called court plaster. A few grains of isinglass boiled in milk forms a most nutritious food, which is given medicinally.

Ignorant of its abundance in certain fishes of the Hoogly, that used by the English residents in India is still imported, probably at an expense of about 800 Rs. per maund,* while the same thing is collected in abundance and shipped to China from the Calcutta river.†

Ten grains of this substance is sufficient to give the consistency of jelly to a pint of water, and as it keeps good in a dry state for any length of time, we may imagine its value as a portable food, and what its importance might be in times of scarcity, since one pound avourdupois, at the above rate, would afford a nutritious meal to 1560 persons.

Whether it be used in times of scarcity in China I do not know, but probably it is collected and stored to meet such occasions, since Dr. Lumqua—an honorary member of this Society—a Chinese Physician, long resident in this city informs me that the Bengal *fish-sago* procured from *Poly-nemus sele*, Buch. is known throughout the empire, and that nothing could surpass his surprise on his arrival nearly twenty-five years ago in Calcutta, when he found that with the exception of his own countrymen who carried on the trade, no one appeared to know or care anything whatever for the article in question, and as no one could describe the fish, the same ignorance continued up to within the last few months to prevail on the subject. The advantage, however inconceivable of an abundant supply of any substance, a single maund of which would afford a nutritious meal to upwards of one hundred thousand persons, could only be felt occasionally, but the intrinsic value of the article in all the common conveniences of

* It is retailed in Calcutta at a much higher rate.

† See Journal of the Asiatic Society for March 1839.

life, is eminently calculated to direct attention to other uses of the species affording it.

This is one of the largest and finest fishes, both as regards flavour and wholesomeness, on our coasts or in our rivers, while the season at which it is taken is the one most favourable for a residence in boats or ships in the Sunderbuns. Under these circumstances it is not likely that the subject of sea fisheries in this quarter will be altogether overlooked, longer than the circumstances on which their success must depend shall have been properly examined.

All sea fisheries are practised on migratory species, which advance annually at stated periods in search of food and proper situations to deposit their spawn. Their progress is so regulated, that at certain seasons they approach the different coasts, in their course, with so much regularity as to enable the people to repose as much confidence and hope in their coming and departure as they usually place in the ripening of their crops. The shoals of fishes are so dense as to cover the sea for leagues without interruption, and extend to a solid depth of many fathoms in some instances, so that they are taken as quickly as it is possible to salt and barrel them. The season lasts from a month to six weeks, when thousands of ships are laden with cargoes which are to serve as the common stock of food for many of the surrounding nations for twelve months, when the fishing is recommenced.

Such are the fisheries on the banks of Newfoundland, on the coasts of Norway, Sweden, and Great Britain; and unless the coasts of India afford promise of resources of similar extent and importance, the object would hardly require much public attention. If, however, it be found that we have species on our coasts equal in every respect to that which is the object of enterprise at Newfoundland, and that these advance into the Sunderbuns at a season when ships and men without number may be employed with safety, there can be nothing to prevent the national importance of the circumstance.

In this instance, as well as in that of the propagation of fresh-water spe-

cies, science, while it exhibits varieties as numerous almost as the stars, teaches us at the same time how to strip the subject of vagueness arising from this cause, and amidst the countless species which inhabit our seas, directs our attention and our energies to a few only, and of these the *Sulea*, or *Polynemus sele*, Buch. is the one which from its bulk, its habits, and its qualities in every way seems capable of becoming a permanent benefit to society. It appears to be the Cod-fish of the tropics, and equals its representative in the northern seas in all those qualities which render that species so invaluable; but from its bulk it is unmanageable by the Indian fishermen, who are also without the means of preserving it.* These however are not sufficient reasons why an article that might add an exhaustless supply to the common stock of food should be altogether lost, now that an European spirit, under the influence of a paternal government, begins to infuse itself in all things connected with the resources of India.

* It must have been long known that the difficulty of preserving meat depends more on the state of the atmosphere in regard to electricity and moisture than on temperature. In Calcutta, in the month of December, when the mean temperature is about 60°, it is not uncommon to keep meat before it is dressed for eight days, though in England during the summer at the time of the herring fishing too, it cannot be kept in the best meat-safes for more than half that time, though the temperature be lower than here. With salt and other means at hand, I conceive there would be no difficulty in curing fish in an Indian climate in the months of November and December, when the *Sulea* fishing would be carried on; nevertheless the subject is one of much interest, and I cannot therefore omit the following remark with which I have been favoured on this head by Mr. C. K. Robison, one of the Magistrates of Calcutta. "It would be a famous thing if these enormous fish (the *Sulea*) could be cured, as well as their isinglass obtained; and I cannot help thinking the measure very feasible, if the fishermen at the time of taking them and cutting them up, dipped them first into weak chloride of soda mixed with a small quantity of impure pyroligneous acid. This would not only preserve the fish till the salt acted, but improve the flavour." These materials could be manufactured at a very cheap rate on the spot, as well as every thing else that would be requisite. For an account of the *Sulea* fish, see Journal Asiatic Society Bengal, March 1839, p. 203. Also an article on "some Indian Fishes by Dr. Cantor," Proceedings Royal Asiatic Society, April 1838.

Desiderata.

Collections of fishes from Mysore, as well as other parts of India in which similar isolated waters occur, with remarks on the habits of the more important kinds, as well as on the fitness of the waters for the mode of propagation here proposed, or for any other mode that might promise more success, according to particular circumstances.

What are the migratory fishes of the coasts of India, the seasons and places at which they appear, particularly the grand resorts of the shoals?

What are the habits of the *Sulea*, (*Polynemus sele*, Buch.) and its chief places of resort?

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